Welding Engineer

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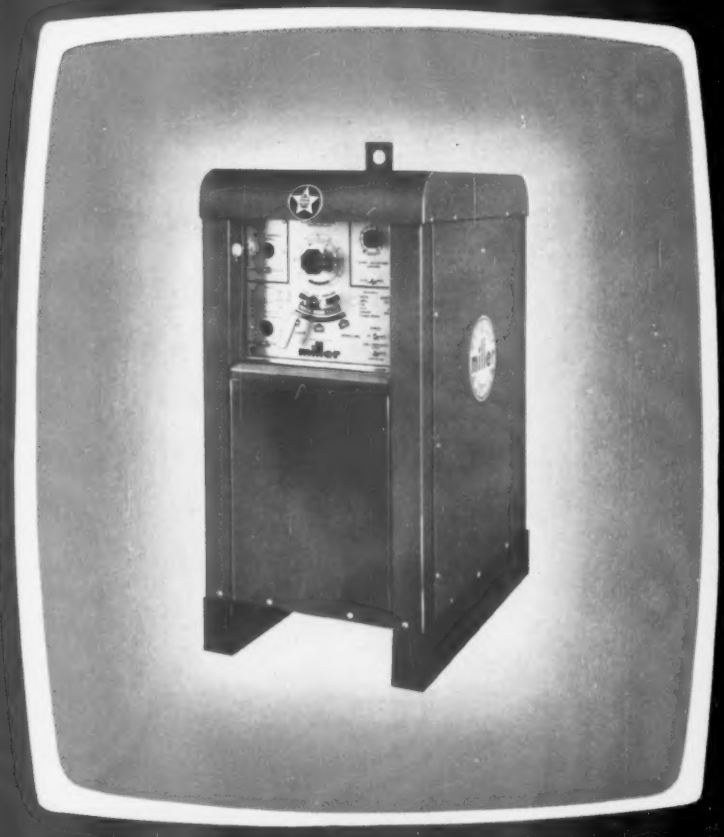
NOVEMBER, 1957



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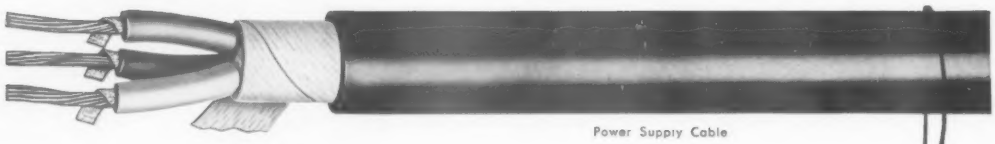

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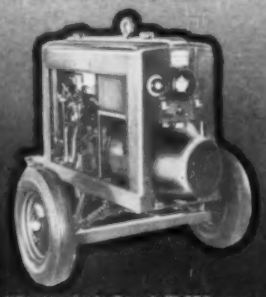

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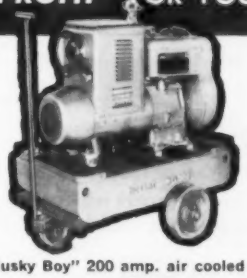

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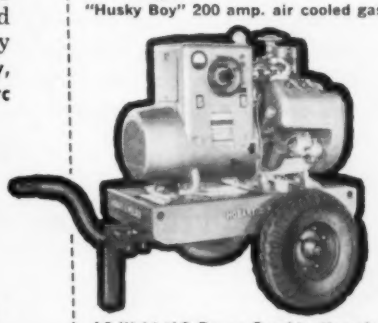

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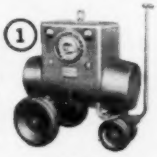
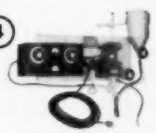


① Electric Drive

② AC/DC Combination

③ DC Rectifier



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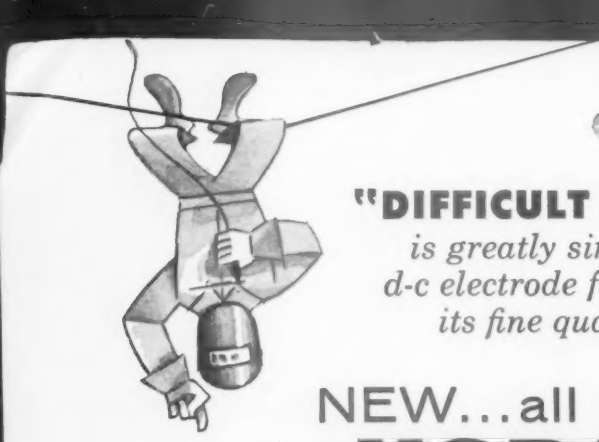

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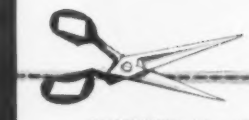

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Welding Engineer

NOVEMBER, 1957
VOL. 42—No. 11

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's Pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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JACKSON for ARC WELDING

Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

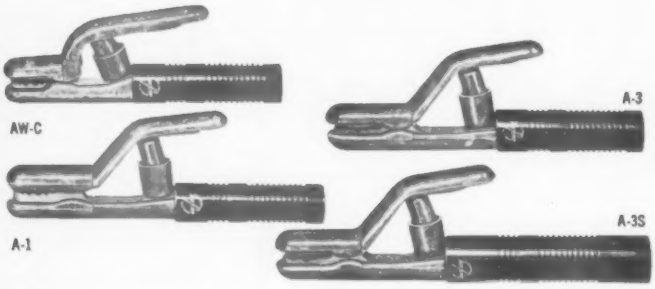
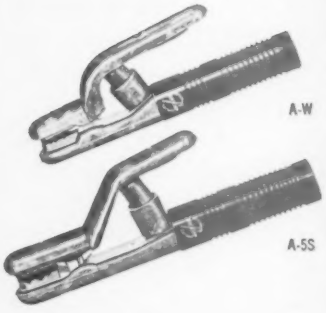


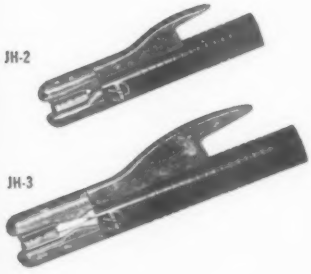
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A5-S	3/8"	500—4/0		80%



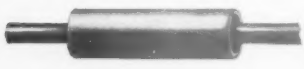
Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.



Cable Splicers for permanent connections. Copper alloy with hard fiber insulators.

Cable Lugs of cast copper alloy, 180 and 45 degrees.

Jackson Ground Clamps, Cable Connectors, Splicers and Lugs are available in three sizes:

MODEL	CABLE SIZE	CABLE CONNECTION	CAPACITY
No. 1	4 thru 1/0	Mechanical, soldered, or brazed	300 amps
2/0—R* and 2/0	1/0 and 2/0	Mechanical, soldered, or brazed	500 amps
4/0—R* and 4/0	3/0 and 4/0	Soldered or brazed only	500 amps

*Cable Connectors only

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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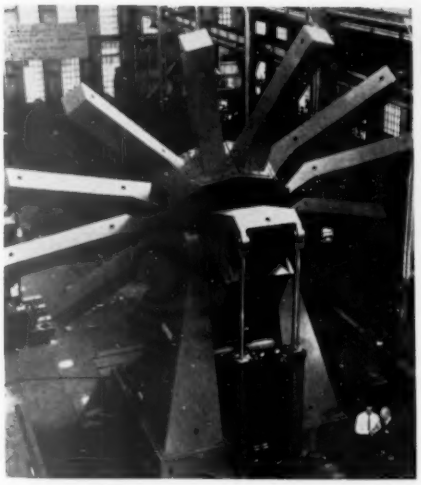
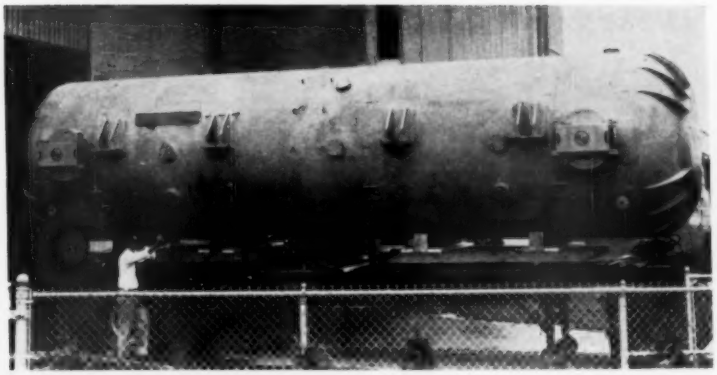




ABOVE: This giant "atom smasher," the pressure tank for the world's first 10-million-volt Tandem accelerator, is 34 ft long and 8 ft in diameter. The 35-ton Van de Graaff accelerator was manufactured by High Voltage Engineering Co.

LEFT: Sun god? Modernistic Buddha? Neither. This huge (100-ton) welding positioner is shown undergoing tests in a San Francisco shipyard. (See story below.)

News

Navy purchases huge positioner

A huge welding positioner will be used to hold extremely large units in place for automatic welding at the Mare Island Naval Shipyard, Vallejo, Calif. Said to be the largest of its kind in the world, the Pandjiris designed positioner was built at Bethlehem Pacific's San Francisco shipyard.

The sun-dial type table has a diameter of 33 ft; the positioner has an over-all height of 20 ft 10 in. and weighs 100 tons. With a 2,000 lb hydraulic system operating two plungers, the table can be tilted to any angle up to 60 deg.

A 2-hp motor turns the table from .005 to .05 rpm, so slow that movement can scarcely be seen (a complete revolution takes over 3 hours). A 7½-hp motor is used for rapid traverse. After being completely dismantled, the positioner was shipped by truck to the naval shipyard.

London Branch for Air Products

Air Products, Inc., Allentown, Pa., now has an overseas counterpart—Air Products (Great Britain) Ltd., organized by the Allentown firm and Butterley Co. of London. Manufacturing facilities and personnel of a former subsidiary of the Butterley Co. will form the nucleus of the English branch. The plant is in Acrefair, North Wales (G.B.)

Air Products designs, manufactures, installs and operates oxygen plants and other low-temperature equipment. Two oxygen plants, each over 200-tons-per-day capacity, are being built in England.

Dexter Baker, former general sales manager of Air Products, Inc., has been named managing director of the English branch and will headquarter at administrative offices in London.

IOMA winter meet in Chicago

The Independent Oxygen Manufacturers' Association will hold its annual winter meeting at the Edgewater Beach Hotel, Chicago, Nov. 4 to 6. The three-day session will feature technical papers, speeches on phases of the compressed gas industry and election of officers for 1958.

Engwald Corp. gets larger quarters

The Engwald Corp., makers of welding fume exhausters, recently moved to 125 Sheridan Blvd., in Inwood, L.I., N.Y.

Husband, wife first in Lincoln contest

A husband and wife engineering team won The Lincoln Foundation's first prize awarded for designs of machines and structures improved through welded design.

Charles and Ann Hutchins, University of Michigan undergraduates, won the first award of $1,250 for their entry, a design of various parts used in a welded two-stage press. Hutchins is enrolled in the Mechanical Engineering Dept., his wife in the College of Architecture and Design. Each department was given $500 in scholarship funds.

The second award of $1,000 went to another team, Eugene A. Jahnke, Charles City, Ia., and Keith Wilson of Monroe, Wis., who designed a welded rigid steel frame for an elementary school building. They are at Iowa State College's Department of Architectural Engineering, which received a scholarship fund of $500.

The design of a machine for handling work for automatic welding won Donald Malcolm, Pittsburgh, third award of $500. The Machine Dept. of Cornell University got $250 in his honor.

Heat-treating covered in new report

The Army's metal heat-treating facilities at the Watertown, Mass., arsenal are described in a report "Construction and characteristics of heat-treating facilities at the Watertown Arsenal laboratories." No. PB 131116 can be ordered from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D.C. for 75 cents.

SEVERAL blocks west of its old site, Hobart North Welding Supply, Inc., built this new 2,000 sq ft building at 5439 W. Diversey Ave., Chicago. The firm was founded Oct. 15, 1954, by Ed Mors, vice president and general manager, and Vern Miller, president.

HOT DOG! Guess again. These gigantic frankfurters are really 15-ft forged seamless steel cylinders to store oxygen in submarines. To utilize every inch of space, they are curved to fit hull contour. Here, cylinders are being painted prior to shipment. (See story below.)

Team formed to combat radioactivity accidents

With more and more radioactive material being used in industry, isotope accidents are more frequent. Tracerlab, Waltham, Mass., has organized several flying squads of qualified technicians to combat these accidents. Taking portable test equipment with them, they travel to the scene of the accident to find the materials, determine their strength and clean up the accident.

Miller Electric adds to plant

To meet the growing demand for its welders, Miller Electric Mfg. Co., Appleton, Wis., recently broke ground for a 70 ft by 265 ft manufacturing building, adjacent to their present plant. The company is also expanding its office facilities.

Mallory-Sharon offers new titanium alloys

After two years of research, Mallory-Sharon Titanium Corp., Niles, O., offers two new titanium alloys which reportedly have superior properties for high temperature applications.

MST 2.5A1-16V is 2.5% aluminum, 16% vanadium and the balance titanium. This alloy was developed to meet the aircraft industry's need for a titanium sheet alloy. Alloy MST-821, 8% aluminum, 2% columbium, 1% tantalum and the balance titanium, is a weldable sheet and bar material. It has about 200 F strength advantage in 400 to 1,000 F.

"Both alloys should have a promising future," says Lee S. Busch, director of engineering. "The combination of weldability, high temperature strength, good formability and other properties is greatly needed in advanced manned aircraft and missile production."

Kansas youth wins farm welding prize

Gary Neuschafer of Hope, Kansas, copped top honors this year in the James F. Lincoln Arc Welding Foundation's national farm welding competition. The high school boy won the $600 first award for describing his farm-mechanics-welded-shop project, a wagon chassis. His school received a duplicate prize, in his honor, for use in the shop course. Gary's teacher, William Reynolds, got a bronze medal and citation.

The 100 Lincoln awards were scattered among boys in 26 different states. Entries were received from nearly every state, the Foundation reports.

The annual event is held to encourage high school students to study how arc welding can improve farming and farm equipment.

A $400 second award went to Leemer Gene Cernohlavek of Weston, Neb. Third prizes of $200 were given to Larry Dickinson, Doyle, Calif., and Tom Schultz of Davenport, Wash. Their schools got like awards.

Any high school student living or working on a farm or ranch is eligible to enter the contest for the new school year. For information, write to the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

Giant "hot dog" to store gases

With helium and argon gases becoming more and more prominent in welding, high pressure containers to handle these gases are in demand. The forged seamless steel cylinders hold gases and chemicals under pressures up to 10,000 psi.

The giant cylinders shown are manufactured by U. S. Steel's National Tube Div. at the Christy Park Works in McKeesport, Pa.

Heavy wall (up to 3 in.) cylinders of high alloy steels are needed for new gases. The vessels are made to stand rigid tests for both stationary storage and transporting gases.

Doughty changes name, address

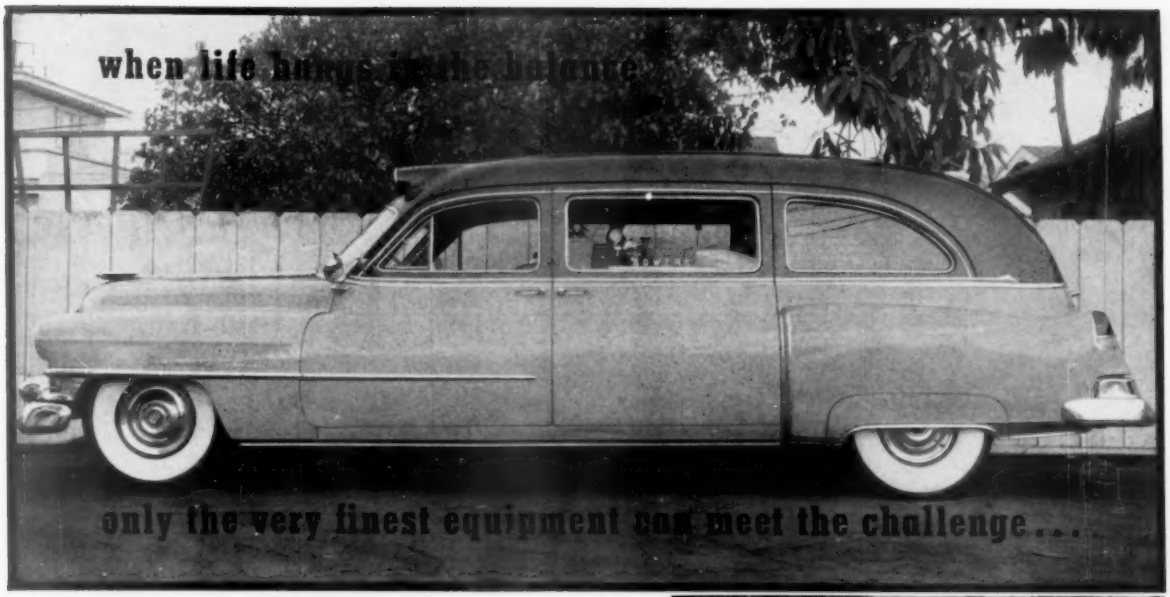
Doughty Laboratories has adopted the name of its product, a case hardening compound, to become Hard-N-Tuff Corp., and has moved from New York City's Fifth Ave. to Huntington, New York. Mailing address is Box 275.

Metal scientists Russia-bound

A group of metal scientists connected with New York University recently left for three weeks in Russia. They are the U.S. half of an exchange of metallurgical scientists with the Moscow Steel Institute. The Russian delegation will be in the U.S. in time for the November World Metallurgical Congress in Chicago.

Among those making the Russian

(Continued on page 103)



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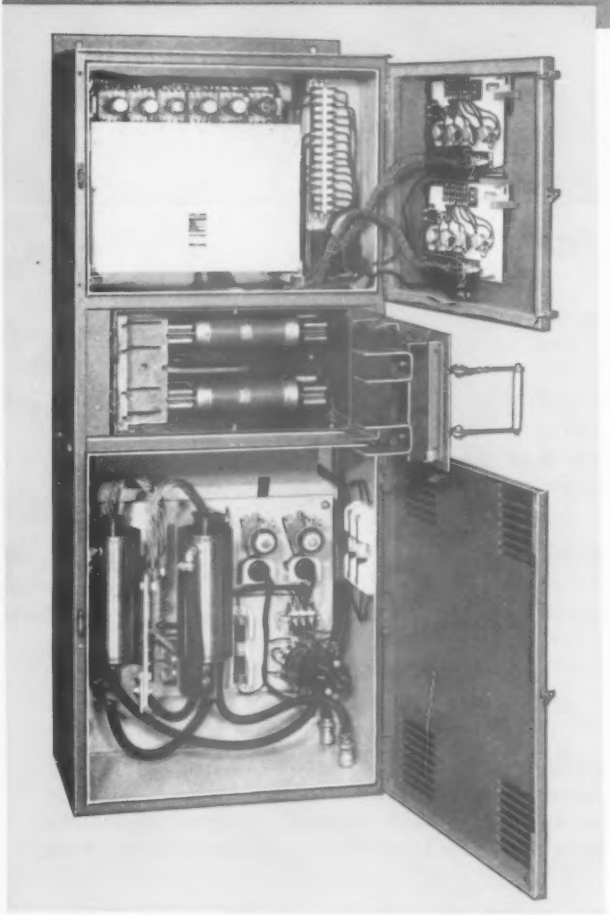


Square D's *High-Speed* Electronic Welder Control

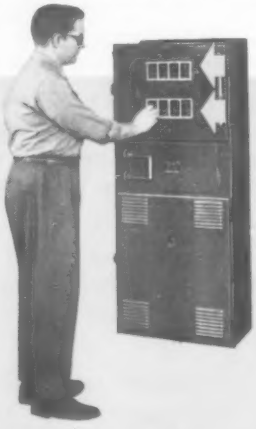
faster! More spot welds per minute for repeat gun or machine welding operations . . . obtained by providing an additional SQUEEZE DELAY timing and a negative HOLD time sequence.

more consistent welds! Synchronized firing of ignitron tubes (welder transformer) and full cycle conduction provides uniform heat for each weld. Vastly improves quality of work.

less maintenance! Control unit uses heavy duty relays and components specifically designed for high speed welding service. Minimizes down time.

plus safety! Square D Fail-Safe tube circuits do not require conduction of an electronic tube to stop the weld . . . less possibility of danger to the operator and damage to the machinery.

Write for High Speed Welder Control Bulletin #8992. Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.



dual **SEQUENCE ADJUSTMENTS** . . . provide complete control of two welding guns operated from one welder transformer and controller.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Invest in knowledge

Dear Sir: *Staten Island, N. Y.*

I am positive that we in the welding field cannot get a better value for a small yearly investment than WELDING ENGINEER. I feel that those who earn their living from welding *must* invest a portion of their earnings into obtaining knowledge of advancement in this ever-changing field, and WELDING ENGINEER, along with AWS membership fills the bill.

Howard J. Shanley
Bethlehem Steel Co.

WE a teacher

Dear Sir: *Chicago*

I enjoy your magazine very much. In the two years I have received WELDING ENGINEER, I have learned more, and have gained more reference material from it than I got from a $300 correspondence course from one of the major correspondence schools. I would estimate the material offered in this course to be obsolete by 20 to 30 years. The little information of recent methods was touched upon so lightly as to be valueless.

Arnold Sutor
Chicago Bridge & Iron Co.

Nondestructive testing

Dear Sir: *W. Roxbury, Mass.*

Your August issue was read with great interest. Accurate descriptive information at the workman's level is needed to publicize proper use of these powerful tools of nondestructive testing. Only by such articles will these tools be appreciated and utilized to their fullest extent. Let's have more and bigger articles in this vein.

Patrick C. McEleney

Tough! as they come

ATLAS TOMAHAWKS

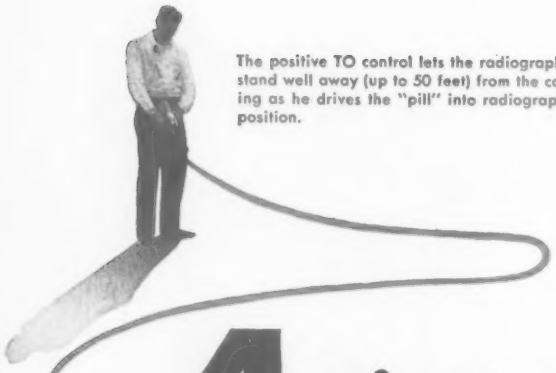
Biggest sellers in the Atlas line—All-steel
"Rebit" replaceable bit Tomahawks with steel handles
"Dual Tools" Tomahawk and brush with and without replaceable bit
One of a big selection of Atlas wood handle Tomahawks
Atlas quality in low cost all-steel Tomahawks

Ask your welding supply dealer to show you the Atlas line

They ask us: WHY 30 MODELS?

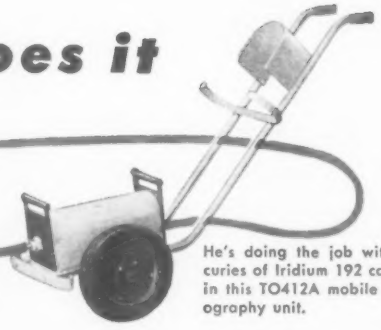
We Answer: —because weld cleaning jobs offer such a wide variety of problems—because welders have strong preferences for certain tool styles. Atlas has made a sincere effort to provide you with the tool you want regardless of your likes and dislikes, in ATLAS QUALITY!

ATLAS WELDING ACCESSORIES INC.
707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.



The positive TO control lets the radiographer stand well away (up to 50 feet) from the casting as he drives the "pill" into radiographic position.

4 minutes *does it*



He's doing the job with 50 curies of Iridium 192 carried in this TO412A mobile radiography unit.

The man up there radiographing that 2″ thick steel casting down there will have the job done in four minutes.

That's how fast modern gamma radiography is.

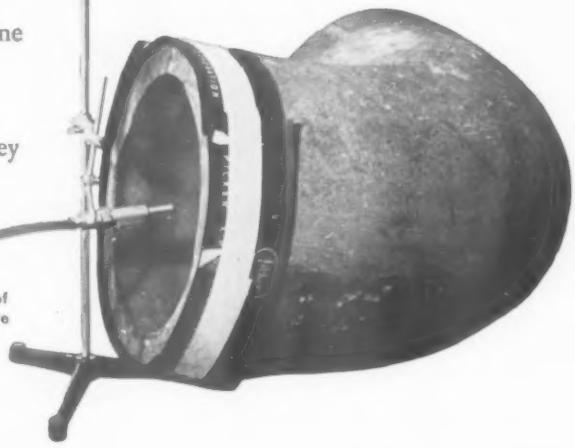
The isotope he's using (Iridium 192) will give him 2% sensitivity, too. Matter of fact, you can easily get 2% sensitivity in sections up to 6″ of steel, brass, copper, bronze . . . even *lead* . . . when you match the isotope to the job.

Makes no difference what you *make* or *buy* or *sell* (plastics, light metals, fabricated parts, assemblies—the list is endless) if it needs radiographic "seeing into" for quality control, we have the machine (gamma or x-ray) to do it most efficiently.

If *you are* confronted by an inspection problem why not let our consulting radiographers see what they can do for you? It will cost you nothing, may save you a lot. Call your local Picker* representative or write us outlining the situation.

Picker x-ray

25 South Broadway, White Plains, N. Y.



One "shot" radiographs the entire girth of the casting. Picker Flexible Film Holders are quickly taped on, quickly removed.

**There's probably a Picker district office near you (see your local 'phone book).*

PICKER.. one stop for everything in industrial fluoroscopy and radiography

ANDREX lightweight portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV and *Andros*cope X-ray Stress Analyzer.

PICKER x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty, x-ray diffraction apparatus, rayproof inspection cabinets.

ACCESSORIES . . . films, tanks, darkroom sundries, illuminators, *everything.*

TECHNICAL OPERATIONS units for isotope radiography—sources, equipment, containers for Iridium 192 Cesium 137 Cobalt 60 and Thulium 170.

In a comparison of A. O. Smith D-C rectifiers vs. M-G sets...

MOST WELDERS CAN'T TELL THE DIFFERENCE...ANY "COSTS MAN" CAN!

THERE'S LITTLE DIFFERENCE IN ARC ADJUSTMENT CHARACTERISTICS BETWEEN A. O. SMITH D-C RECTIFIERS AND M-G SETS — and a blind-fold test will prove it! With its arc booster arrangement, an A. O. Smith d-c rectifier can provide any of four characteristics at the flip of a switch — *booster on* for fast striking . . . *booster off* for quick work on routine jobs . *smooth arc* for perfect welds on light gauges . . and *forcing arc* for deep penetration. In effect, an A. O. Smith d-c rectifier provides most of the arc adjustments previously possible only with m-g sets.

A. O. SMITH D-C RECTIFIERS COST FAR LESS TO MAINTAIN THAN M-G SETS — no commutators, brushes, wires or bearings to wear and need replacement. No frequent inspections and lubrication. In a matter of months any costs man can tell there's a big difference in operating economy in favor of the A. O. Smith d-c rectifier.

Your man from A. O. Smith will be pleased to arrange a demonstration. Contact him now. Or write direct for information.

A. O. Smith rectifiers are available in quality built 200, 300, 400, 600, 800, 1000 and 1250-amp models. Larger models for power applications may be had in up to almost any rating.

Through research ... *a better way*

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. SMITH INTERNATIONAL S. A.
Milwaukee 1, Wisconsin, U.S.A.

How to Build 4½ Million Pounds of Power Shovel . . .

Fabricating the "River Queen", a 13-story high steel giant that weighs as much as a Navy destroyer, calls for the kind of engineering Bucyrus-Erie knows how to handle. One of the nation's foremost designers and builders of power shovel equipment, Bucyrus-Erie used the latest welding techniques, tailoring each weld to resist the strains of the big machine as it bit off 80-ton chunks of mountain and dumped them 300 feet away.

Frame, boom, bucket and its other vital parts had to be rugged to withstand the 100,000-ton-per-day earth-moving pace for which the "River Queen" was designed. Electrodes were therefore selected for their ability to produce sound, reliable, impact-resistant welds.

The task of selecting electrodes to meet the specific demands of any welding job even as complex as the "River Queen" has been simplified in a new 24-page "Electrode Selector" prepared by Metal & Thermit. Welders, designers, specifications engineers, and purchasing men who use this guide, readily find the correct rod or wire for any particular welding application. Free copies of this handy new tool for the welding trade are available from the

METAL & THERMIT CORPORATION
Rahway, New Jersey

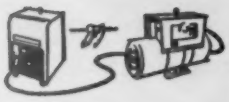
NOVEMBER
1957

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.



. . Air Reduction Co., is now sole owner of Arcrods Corp., manufacturer of arc welding electrodes with plants in Cleveland and Sparrows Point, Md. The new subsidiary had been jointly owned by Airco and General Electric Co. Arcrods president, William Brainard, continues in that capacity.

. . Essex Welding Equipment Co., Inc., Newark, N. J., has opened a branch office in New York City. Address is 11 Broadway; phone is Worth 2-3125.

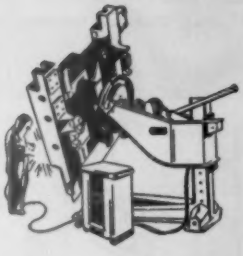
. . Swedlow Plastics Co., Los Angeles, has been licensed by Solar Aircraft Co. to manufacture and sell latter's resistance-welded stainless-steel honeycomb core in the United States and Canada.

. . General Electric's York, Pa., facilities had still not been disposed of as we went to press . . . though two manufacturers of arc-welding equipment are still interested in the site.

. . The Burdett Oxygen Co. has just put into operation its new million-dollar liquid-oxygen plant on Cleveland's lake shore. For more details, see next month's Welding Engineer.

. . According to Congressional joint economic committee, gross national product in current prices will probably be at a seasonally adjusted annual rate of $443 to $445 billion in this fourth quarter of 1957. This would mean an average of about $436-$437 billion for year as a whole.

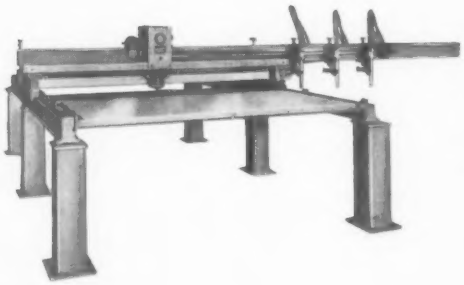
. . Despite Ike's assertion that we weren't in a race with anybody to launch an earth satellite, look for renewed vigor in the nation's rocket and missile program. Russia's Sputnik, circling the globe, produced repurcussions on the stock market as well.



. . Bright industrial picture for nickel was painted by C. M. Schwitter, Inco's market research manager in recent speech. Increased world production and research, he said, should serve to reassure . . . that nickel can safely be considered for long range plans.

Every Product . . . every Process to fit every Welding and Cutting Purpose — Best!

Photoscope Electronic Tracer



HANDS OFF!

Illustrated below are some examples of intricate shapes cut by the BURDOX Statosec Shape Cutting Machine.

BURDOX STATOSEC

cutting machine does its own thinking for you!

The amazing BURDOX Statosec Shape Cutting Machine with Photoscope Electronic Tracer *automatically* reproduces the most intricate pattern! A low cost cut-out or drawing is the only pattern necessary. Accuracy is so precise that machining of finished pieces is often unnecessary.

Steel warehouses, car shops, fabricators, tank shops, die shops, or any plant cutting metal can utilize Statosec for economical reproduction of intricate shapes even from small pieces of plate or for stripping extra long plates. A varied range of heads cover any possible application.

Send coupon for complete details.

Please send Free Literature on BURDOX Statosec

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Firm .....

Address .....

City ..... Zone ..... State .....

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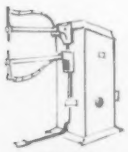
PLANTS: Cleveland, Dayton, Findlay, Mansfield, Youngstown, Ohio and Los Angeles, California

BRANCHES: Akron, Cincinnati, Columbus, Ohio

Industrial Gases

Gas Welding Equipment

Arc Welding Equipment



Spot Welding Equipment

Soldering, Brazing Equipment

Safety Equipment

Cutting Equipment

Accessories

30 YEARS AGO

(Taken from *The Welding Engineer* of November, 1927)

Marching World War I soldiers illustrate a welding torch firm's advertising claim, "Drilled for precision."

—30 YEARS AGO—

From the editorial page: The blessing of a trade mark is that it identifies those ingredients which do not appear in the formula.

—30 YEARS AGO—

H. E. Wetzel, Jr., engineer for Smith & Oby, Cleveland architects, believes without any question that welding is the ideal method of pipe fabrication. Men like Mr. Wetzel undoubtedly are doing a great deal to spread the gospel of welding among other engineers.

—30 YEARS AGO—

Edward T. Moore of Syracuse, N.Y., recently put on the market a device called a "power demand limitator" to reduce excessive peaks on electric power systems. It is claimed that such a device can be used with electric arc welding and electric resistance welding installations.

—30 YEARS AGO—

Smith Welding Equipment Corp., Minneapolis, recently introduced a welding torch furnished with an insulated tip.

—30 YEARS AGO—

Welded pipe becoming standard, headlines one story. Leak-proof construction is most important, welded lines are better adapted to varied conditions, more resistance to stresses and corrosion are advantages listed.

—30 YEARS AGO—

Linde Air Products Co., New York City, plan to erect a new plant at Erie, Pa.

—30 YEARS AGO—

A major article on gas welding galvanized tanks tells production methods which make it a simple matter to keep the finished article up to standard.

—30 YEARS AGO—

A consulting engineer who can make welding fundamentally right in any plant will more than pay his way.

Which do you have?

"Shortstub"
ELECTRODE HOLDERS

convert the **total** fluxed portion of electrodes into **weld metal. Reduce stub waste to the lowest possible...** which means

DEPOSITED WELD METAL COSTS YOU LESS, 15 to 20 percent less, when deposited with SHORTSTUBS!

A Saving of $15.00 to $20.00 of every $100.00 spent for electrodes!

PIONEER FOR
BERNARD
MODERN WELDING

WELDING EQUIPMENT CO.
10232 S. AVENUE N
CHICAGO 17, ILLINOIS

Contact your local distributor

BRAZED SUCCESSFULLY

WITH

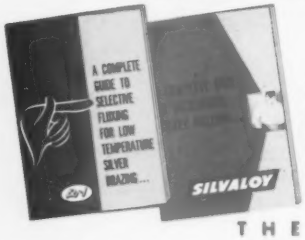
SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

"King-Seeley Corporation, Ann Arbor, Michigan, is one of the leading manufacturers of original equipment automotive instrument panels, gauges, speedometers, governors, electric meat thermometers and range surface element controls. Its Central Specialty Division produces many of the famous Craftsman line of power tools. Its Signal Electric Division makes Signal Electric fans." ★ ★

KS

CRAFTSMAN®



Two complete reference manuals for low temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★

Here's a top performance soldering gun designed and built by the King-Seeley Corporation for Sears, Roebuck & Company and marketed under their famous Craftsman quality trademark.

The specifications for the Craftsman gun describe a high quality product that must be soundly engineered and manufactured for prolonged, dependable service. The tips are assembled to the rods, fluxed and Silvaloy brazed. Subsequently the tips themselves are dipped to apply a Silvaloy coating. Silvaloy is employed primarily because of its relatively low melting temperature and its ability to be applied by a dipping process —with a floating flux. Its use is efficient and practical in this application, also, because of its subsequent corrosion resistance in use.

Silvaloy Brazing Alloys and APW Fluxes are helping to speed production, lower costs and improve brazing results in many fields. Call your nearest Silvaloy Distributor for information or technical assistance. ★

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ASK THE MAN BEHIND THE GLOVE...
CAROL AWG 4/O NEOPRENE WELDING CABLE
CAROL AWG 4/O NEOPRENE WELDING CABLE

...He'll tell you about Carol®

DYNAPOWER ARC-WELDING CABLE!

When you call for cable—call for Carol

Quickly available from any of these warehouses!

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Serving industry for more than 30 years

A SUBSIDIARY OF Penn-Texas CORPORATION

MEMBER NATIONAL WELDING EQUIPMENT ASSOCIATION

how's this for *performance?*

15 lbs. of scrap after cutting 156 parts from a 6′ x 10′ plate of ⅜″ steel

Using four torches guided by an electronic tracer, an Airco #48 Duograph automatically flame cut 156 parts from a ⅜″ x 72″ x 120″ steel plate. Of the original 918 pounds of sheet steel, only 15 pounds of scrap remained. Discover the advantages to be gained by using Airco flame-cutting machines for fast, economical production. In addition to the #48 Duograph, Airco flame-cutting machines include the Airco Travograph, Oxygraph, Duograph, Monograph, Camograph, and Radiagraph. Write Airco for complete information and literature.

welding
AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

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AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast — Air Reduction Pacific Company
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In Cuba — Cuban Air Products Corporation
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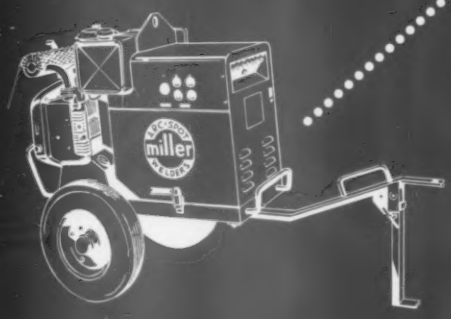
Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO — industrial gases, welding and cutting equipment, and acetylenic chemicals • PURECO — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • OHIO — medical gases and hospital equipment • NATIONAL CARBIDE — pipeline acetylene and calcium carbide • COLTON — polyvinyl acetate, alcohols, and other synthetic resins.

NEW!



Now equipped with a new and larger Onan 12.9 hp engine, the new Miller AEA-200-L produces a full 225 amperes of continuous rated, high cycle welding current or, 5 KW of 110/220 ac power for operation of power tools, lights, milking machines, etc., or, 1 KW of dc power.

Contractors, job weldors, farmers and many industries have shown a continuing high regard for the AEA's weatherproof ruggedness, easy portability and instant changeover versatility from ac welder to power plant to pipe thawer.

Readi-pull starter, rubber tire running gear and road trailer available as optional equipment.

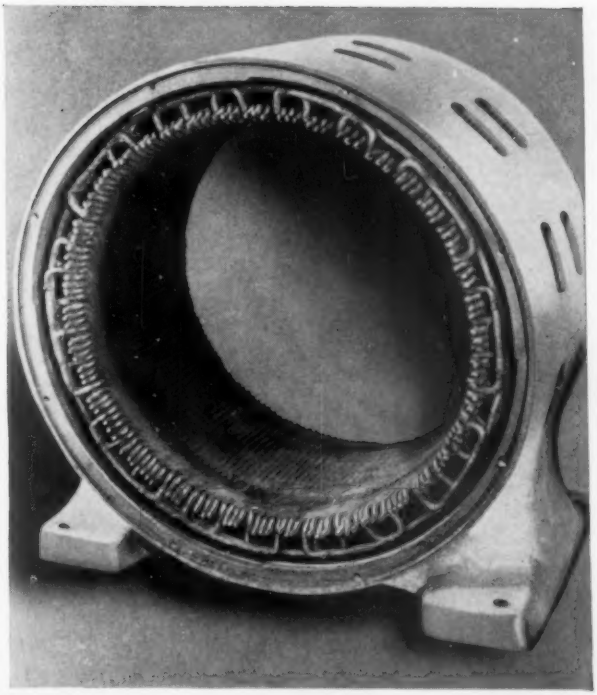
Complete specifications sent on request.

". . . if it's Miller you know it's the finest . . ."

miller Electric Manufacturing Company, Inc. APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD., Montreal

Cracked cast iron motor casing welded with Ni-Rod "55" ...$8000 saved!



When supports of a digester drive motor cracked, production in a Canadian paper mill halted.

A new casting and lost production would cost over $8000!

How about repairing the cast iron supports? Welding Engineers Limited, of Montreal, said it could be done—with Ni-Rod* "55"* electrodes. The company used only 40 pounds of Ni-Rod "55" electrode to do the job. And the digester was back in operation the next morning. Total cost of the repair: $325.

Emergency repairs—and production welding, too—are fast and simple with Ni-Rod "55" electrode. No special equipment. No new training for weldors. Arc is stable and slag removal easy. Most jobs require no preheat.

Repair Cast Iron Parts Quickly and Easily gives illustrated examples of the many jobs you can do with Ni-Rod "55" electrode. For your copy, just write.

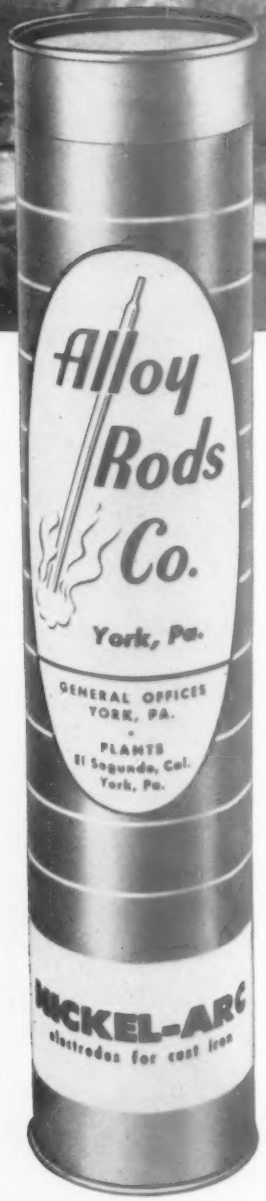
*Registered trademark

The International Nickel Company, Inc.

67 Wall Street — INCO TRADE MARK — New York 5, N. Y.

INCO WELDING PRODUCTS

Electrodes • Wires • Fluxes



Weld cast iron quickly, easily, permanently...with

IMPROVED NICKEL-ARC

A great favorite made better . . . Now the improved Nickel-Arc electrode provides the *ideal* for welding cast iron. An improved coating formulation coupled with the same popular core wire is the answer.

Better machinability . . . Always a popular feature with the Nickel-Arc electrode, machinability has been made even better. Both weld metal and fusion zone are well within the machinable range.

Crack free welds . . . Not only single pass overlays or repairs—even multiple pass fillets and butt welds, and in complex assemblies too, Nickel-Arc welds are crack free.

Easier to use . . . The stable arc of improved Nickel-Arc deposits beads smoothly, easily, into strong, porosity free welds of excellent color match. Works well in all positions on AC or reverse polarity DC.

Get the facts . . . on improved Nickel-Arc electrodes. Your Distributor or Alloy Rods Representative has complete technical data or write for a copy of Bulletin AR-2. Alloy Rods Company, P. O. Box 1828, York 2, Penna.

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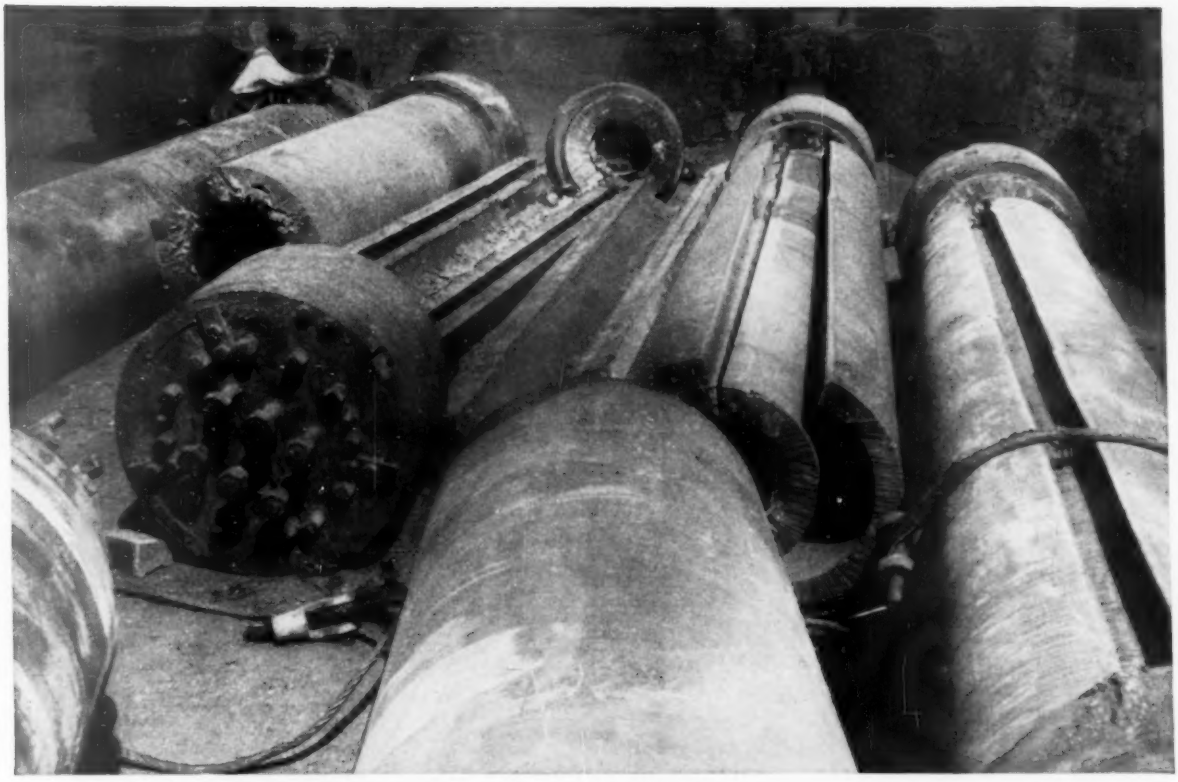

Mechanized Cutting Speeds Scrapping of 95-Ton Pressure Vessels

Scrapping huge pressure vessels loomed as a costly, time-consuming job for a large scrapyard in Birmingham, Alabama. But mechanized oxygen-cutting quickly cut this job down to size—and with substantial savings in labor and materials.

The versatile OXWELD CM-45 Portable Cutting Machine teamed up with a C-56 Blowpipe to slice through 8-in. thick laminated steel walls at a speed of 4 to 5 in. per minute. Two 24-ft. cuts were made in each vessel in less than two hours' time. Transverse cuts were then made to reduce these sections to charging-box size.

Today scrapyards, fabricators, and maintenance shops everywhere are slashing costs with the speed and efficiency of mechanized oxygen-cutting.

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2. Downhand welding — the natural way — increases arc time and eliminates operator fatigue. Deposition is faster because metal flows more readily and pools more evenly. Welds are cleaner and stronger.

Result: Users save up to half of the 86 cents from each welding dollar that goes into labor and overhead — and recover the initial cost of their P&H positioners in a remarkably short time.

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BETWEEN PASSES

whatta claim!

A reader, who evidently believes in welding as strongly as we do, has forwarded us a letter which indicates our work is far from finished. The letter, sent our reader by a Midwest metal firm, describes a products' benefits (?) in this way . . . "Best of all, we have stronger and sturdier racks since no welding . . . weakens the pipes." A pencilled notation by our reader asks, "How do you like this crack?" We don't. In fact, it is just such thinking that we try to overcome. We must all continue, without letup, the task of *selling* welding.

publications

Across our desk recently came two fine examples of public relations. "Facts about Air Reduction" is a handsome 34-page-plus-covers brochure in two colors which gives just that—the story of Airco, its divisions, its products and its services. The other: Miller Electric Mfg. Co.'s *Memco News* for August-September. This was a special air age issue dedicated to aircraft, rockets and missiles. An added feature was the eight-page insert, easily removable, which told the story of "Darius Green and his flying machine," John T. Trowbridge's famous poem.

. . . and publicity

Speaking of publications, the *Brass and Bronze Forging Digest* devoted the lead story of its August issue to Tweco's electrode holder, which is fabricated with forged aluminum components.

design seminars

Seminars for machine designers are now being conducted by The Lincoln Electric Co., Cleveland. Discussions and lectures cover advantages of welding and how to apply them, determining loads, selecting efficient sections, designing welds, relating designs to efficient production methods, and other related subjects and problems introduced by participants. Problems studied are both redesigns of castings to weldments and new weldment designs. One seminar has just been completed. Three more are scheduled—Nov. 11-15; Jan. 13-17; Feb. 24-28. For more information, write Robert Wilson, Director of Application Engineering, The Lincoln Electric Co., Cleveland 17, Ohio.

did you know . . .

That limburger cheese is declining in popularity while Swiss cheese is becoming more popular? That the volume of beer brewed has *increased* by more than 50% since 1940 while the number of breweries has *decreased* by a similar percentage in the same period? You didn't? Well, these facts, along with many others which might be of greater interest to you, are contained in the new 1957 edition of *Statistical Abstract of the United States,* that famed comprehensive tome published by the Bureau of Census. Price tag on the 1,061-page volume: $3.50. It's just the reference work you need for debunking long-standing myths and for making up quiz games.

labor law

A newly produced film covers the history, purpose and principles of our present labor laws. "You and labor law" is a two-part, 30-minute sound-slide film available from Employers Labor Relations Information Committee, Inc., 33 E. 48th St., New York City 17, N. Y. Part one depicted the evolution of labor law philosophy, and part two shows present labor laws in action.

construction boom

According to a recent report of the American Iron and Steel Institute, heavy construction this year is likely to use record amounts of steel. Although *WE* editors chronicle as much about welded construction as possible, we realize that there could be more news about welding in this booming industry. Main reason for lack of same is the lack of welding within the field. Practically a virgin territory, construction too often uses means of fabrication other than welding —despite the efficiency and low cost of our favorite joining method. We have to sell welding . . . let's make construction a prime target.

Sputnik

That's the shortened name of the Russian earth satellite now circling the globe at about 18,000 mph. The Red scientists are not so slow as we would have liked to believe. For more news of Russian technological progress see "Reds receive awards for improving welding," on page 53 of this issue.

from here to . . .

Not eternity, but *WE* does blanket the country fairly well. Our circulation department reports that within one week, *WE* received subscriptions from Broken Arrow, Okla., and Broken Bow, Nebr.

welding month

In the past, we have often listed on this page various special weeks, months, etc., which are dedicated to myriad things, people, and holidays. When you get to the editorial page of this issue, you will note that welding has arrived. It has a month all its own! Well, maybe not all its own, but it does have a month—next September.

and so . . .

We find that November is "Butter-Baked Turkey Time" and "Gift Cheese Shopper's Time."

NEW Airco POP can seals out dampness...

keeps stainless steel electrodes "oven fresh" in re-usable aluminum container — eliminates special storage facilities!

Airco Stainless Steel Electrodes are now packed in seamless aluminum containers. Each "POP" can contains 10 pounds of electrodes, and is sealed with a waterproof airtight industrial tape.

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Airco Stainless Steel Electrodes, in the "POP" can, are but one of many types in Airco's complete line that also includes hard-facing, cast iron, mild steel, general, and special purpose electrodes. Send for the free Airco Electrode Guide which will help you select the right electrode for your special job.

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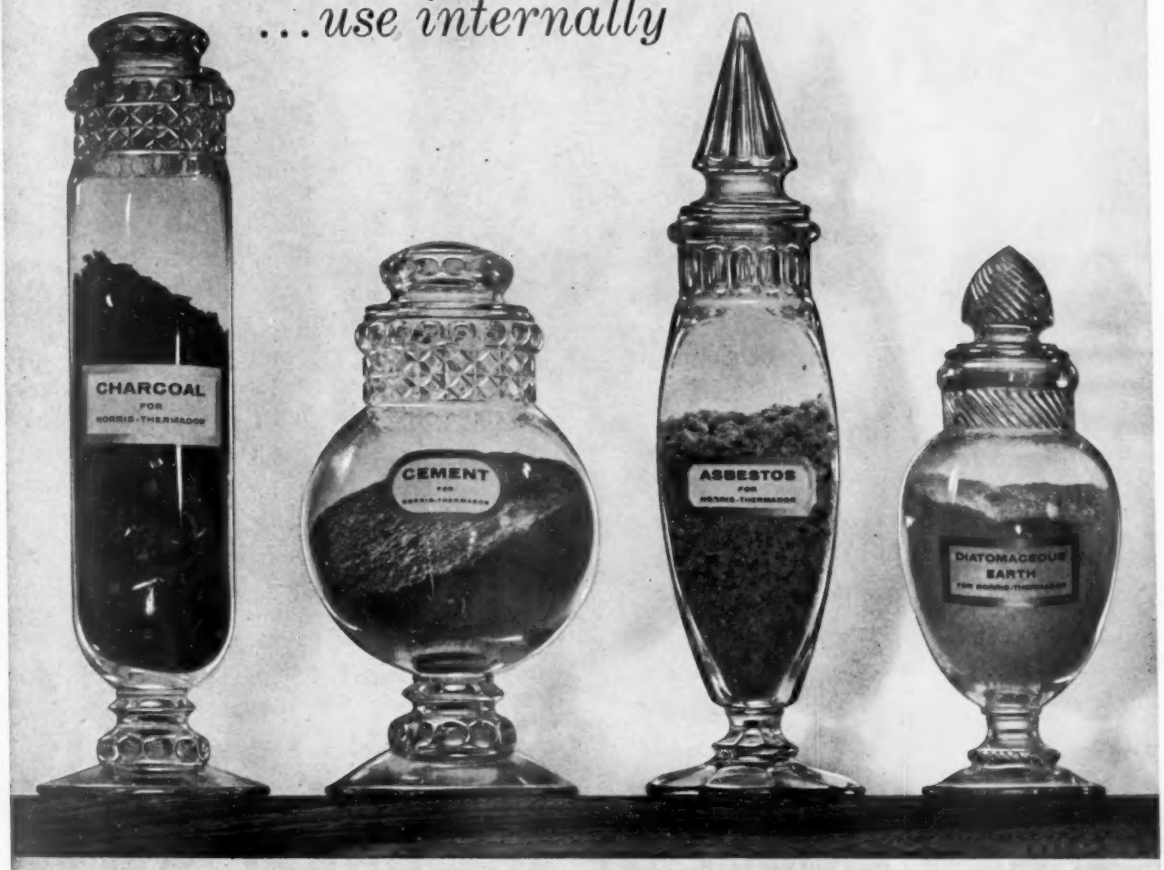

3-1081

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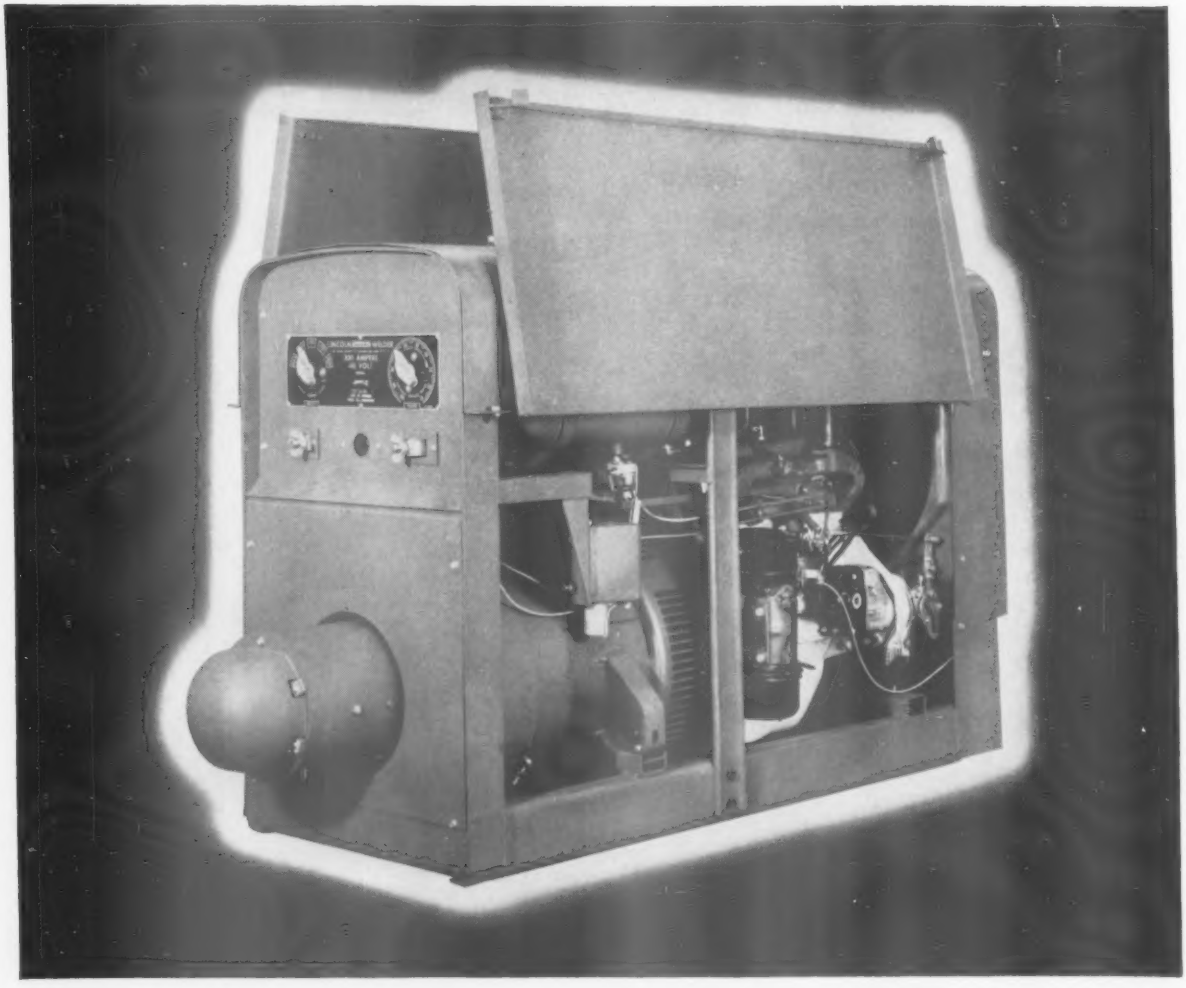

A NEW MODEL OF THE GREAT 6090

the world's most famous welder

Pipeliners and construction welders the world over have acclaimed the Lincoln Model S-6090 for stamina and rugged dependability. Their reliance upon this welder, where the going is tough, has resulted in more Model S-6090's being in use than all other 200 ampere engine-driven welders put together.

With all due respect to this famous machine, we are proud to announce its successor. The K-6090 has all the features of its illustrious predecessor *plus* many improvements designed for more efficient operation.

The popular F-162 Continental engine has been beefed-up to produce *more horsepower.* 36 hp (at the same low rpm) assures top output after thousands of hours of use—gives full welder performance at high altitudes.

Fuel capacity has been increased. *The large 15 gallon gas tank* allows heavy-duty operation for a full 14-hour day without refueling.

Shield-Arc's famous *dual control is even more precise.* Increased steps of current selection provides, exactly, the right type of arc.

The use of heavier gage steel in the top, doors, base, and extended housing makes a *rugged body* to protect the machine from damage.

All these improvements plus the proven dependability of the S-6090 are available in the K-6090 at the same low price.

For details and specifications write for Bulletin SB-1337.

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LINCOLN

NOVEMBER, 1957

Welding Engineer

ESTABLISHED 1916

A month for welding

WELDING, as we've noted on countless occasions, is important to everyone. It is fast becoming (if it isn't already) the fulcrum on which is balanced some large portion of the world's manufacturing ability.

To 90% or more of the U. S. population, the word "welding" means little or nothing. Yet, without the power behind that word, these people would find their standard of living drastically altered. Many of their everyday activities, in fact, would be eliminated.

Most of the pleasant things we enjoy today have been made possible, at least to some extent, by welding. Our autos and planes, golf clubs, fishing equipment, television sets and metal furniture all benefit from the application of one or more welding process.

And, as though to balance these good things in life, welding has also made some unpleasant things possible.

The atomic bomb owes its existence to the scientific use of strong and durable welded equipment. Destructive forces inherent in this instrument of war certainly are not good. But, looking at atomic power from another viewpoint, we find that welding will directly aid physicists of the free world in their nuclear research to eliminate cancer, leukemia and other dread diseases.

WEDDING RINGS are joined in a continuous band by a welding process. Here again, there may be some discussion on the relative merits of such an application, but most of us will agree that a welded wedding ring signifies a highly satisfactory agreement.

We who work in—and with—welding are aware of its many benefits to mankind. Welding to us means more than a job. It's a way of life. It is a group of joining processes aided by a group of severing processes which have made possible the fast and easy fabrication of stronger, lighter, more attractive and generally less costly products for industry and general consumption.

Our friends and neighbors—all of whom benefit from welding—don't know about these processes now. *But they will by next September if we all do a cooperative publicity job.*

If the man on the street thinks of welding at all, he usually connects it only with metals. But there are also common examples of welded glass. Few persons looking at a neon sign would tend to give welding the credit it deserves for the intricate and eye-pleasing designs.

THERE ARE common welding applications, too, in the field of plastics. Raincoats, toys, beach balls, bags for food storage and many other light, transparent plastic objects are joined by welding.

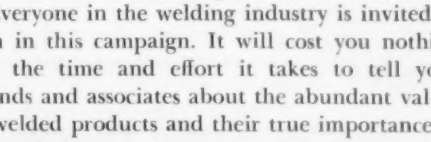
Since welding is such an integral part of practically all the tools and pleasure items used by the public, let's draw their attention to it. Let's make everyone more conscious of the value of their welded products.

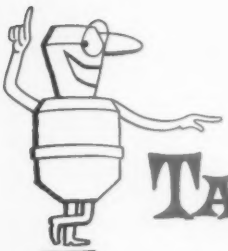
By bringing welded products firmly into the public eye—and by creating a specific demand for them—we can pave the way for more welding jobs . . . sell more welding equipment and supplies . . . and gain for welding and its allied processes the recognition it so richly deserves as a benefactor of mankind.

In working toward this goal, WELDING ENGINEER and its companion publication, THE WELDING DISTRIBUTOR, are sponsoring National Welded Products Month from September 1 to 30, 1958.

Everyone in the welding industry is invited to join in this campaign. It will cost you nothing but the time and effort it takes to tell your friends and associates about the abundant values of welded products and their true importance in our society.

Remember September—National Welded Products Month!





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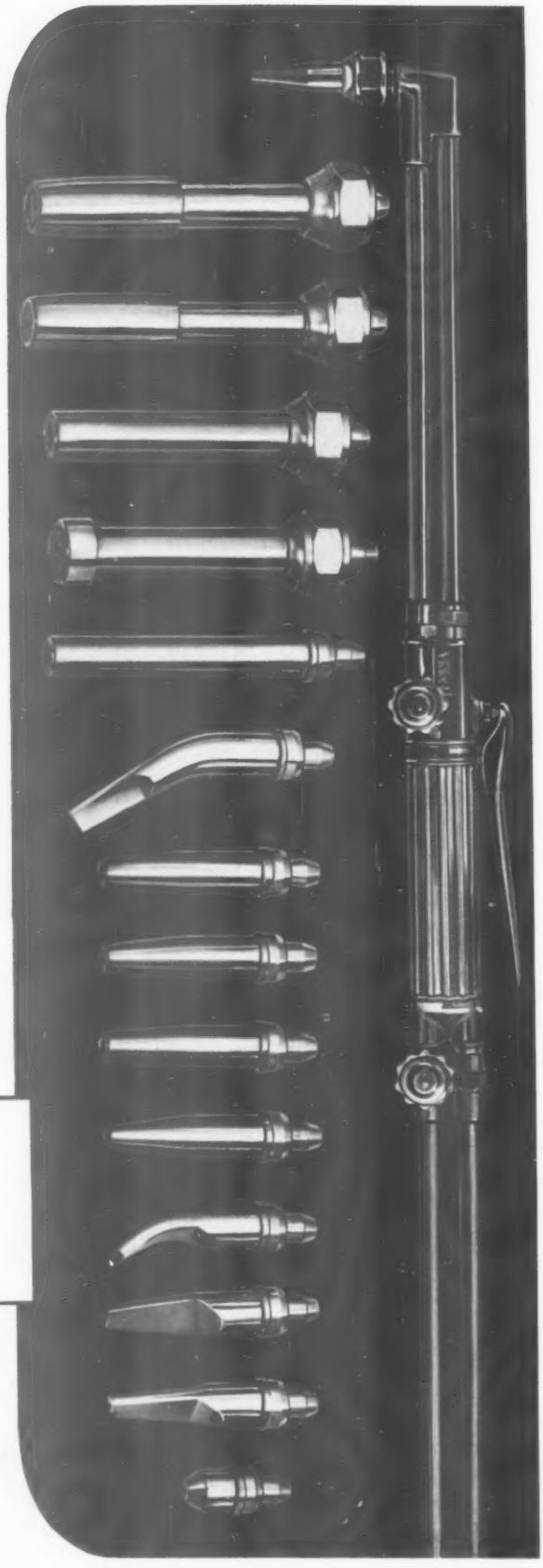

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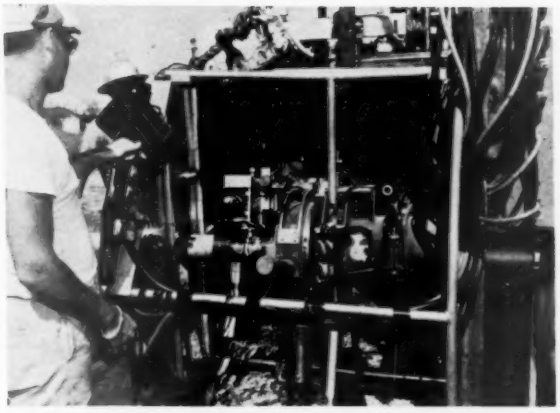


New Mig welder acclaimed in banana-land for joining aluminum pipelines.

LEFT: Close-up view of new automatic Mig welder on the job. A result of five years research and experimentation, the machine made 4 in. circumferential welds on 2,280 ft of pipeline in four hours—an average of 18 welds per hour.

BELOW: Mounted on a tractor, new welder is put through its paces near Corpus Christi, Texas, while laying gas pipeline.

First of its kind—automatic Mig welder for pipelines

In Maracaibo, Venezuela, Reynolds Metals Co. recently took the wraps off an automatic Mig (metal inert-gas) welder described as "the first proved by field tests to be fully operational for pipeline construction anywhere."

The unveiling culminated five years of research and development. Final field tests on the compact unit were held near Corpus Christi, Texas, earlier this year.

Suspended from a side-boom on a tractor, the welder was turned loose on a four-mile section of 4-in. schedule 4 aluminum pipe (6061 T6) and actually completed the circumferential seams in one section of 2,280 ft within four hours . . . an average of 18 satisfactory welds every hour. The pipe is part of a Reynold's gas-gathering system.

Joint Project

Beginning its experiments in the automatic welding of aluminum pipe in 1952, Reynolds met with sufficient success to carry the project to fruition in 1954 in conjunction with Air Reduction Sales Co. First major proofing of the unit was on a 10-mile stretch of gas transmission line . . . at the time the longest aluminum pipeline ever constructed.

The firm felt they had produced a good piece of equipment, but that some refinements could be added to increase operational efficiency. Placed in charge of redesign was Chief Welding Engineer Charles Bruno and his assistant, Dana V. Wilcox.

Results of this development is a new machine similar to the 1954 model. The unit revolves around pipe carrying its gas-shielded arc. Additional inert gas is also released to more fully blanket the weld areas.

A four-pass weld by the 1954 model took two minutes. Joint-to-joint time was a little more than four minutes. No times were released by Reynolds for the new machine, so it may be assumed they are roughly the same as the 1954 unit.

Company officials do, however, list four improvements cited by Bruno and Wilcox:

(1) better welds with more consistent properties;

(2) more automatic features;

(3) more ruggedly constructed;

(4) operation time from joint to joint, is less.

On the basis of improvements and tests, the firm plans to use the welder extensively in Central and South America.

Machine's Future

One large operation zone is in Venezuela where it is used to weld aluminum-jacketed off-shore oil drilling platforms. Coming up is its application on the world's longest aluminum pipeline, in Colombia. This will be a 42-mile length of 6-in. flow line. Its purpose is to connect oil fields in Tibu to the shipping center in Rio de Oro.

Recently the machine was demonstrated at a clinic in Maracaibo co-sponsored by Reynolds and the American Institute of Mining Metallurgical and Petroleum Engineers.

Discussed at this meeting were underwater aluminum flow lines now being laid in Lake Maracaibo. On this project, 17,000 ft of 8.625 in. schedule 40 pipe is being used. This is the largest-diameter aluminum pipe ever used for flow lines. The job will require 200,000 lb of pipe.

LEFT: Going up! Plate for second course of Skokie water reservoir is hoisted by boom on temporary mast in center of tank *(at right, out of picture)*. Tractor backed against plate keeps it from sliding before it clears ground.

BELOW: Dogged floor plates, 5/16 in. thick, are manually welded with ¼-in. E6012 electrodes. Plates rest on thick concrete foundation.

In Skokie, Ill.,—

This welded tank eases a water shortage

AN ALL-WELDED, 4,970,000-gal answer to the long-standing water problems of the village of Skokie, Ill., is in final construction stages.

The water storage tank, which should meet the demands of a rapidly-increasing population, is being erected by Chicago Bridge & Iron Co. The firm estimated time on the job at 12 weeks, and will meet this deadline.

Automatic submerged-arc welding is being used in the field for tank fabrication, in addition to the manual metal-arc process. Welds are made on mild steel plates that range in thickness from 1 25/32 in. at the first course to ¼ in. at the tenth, and top, course. Floor plates, also welded, are 5/16 in. thick.

30-Deg Bevel

Thickest plates for the tank have been beveled 30 deg to form a 60-deg included angle at each joint. As plate thickness decreases in the upper courses, however, amount of bevel is also diminished until, at the top, it becomes unnecessary.

Low-hydrogen E7016 electrodes, 5/32 in. in diameter, are used by manual arc weldors on vertical seams. Bottom plates were welded with ¼-in. E6012's. An arc-air torch was used to back-gouge vertical seams.

Power for manual welding operations is supplied by a bank of 400-amp motor-generator welders. Six passes, including the cover beads, are required in each manually welded joint.

Two automatic submerged-arc welding heads, mounted on a mobile carriage, are joining all horizontal circumferential seams between courses. The carriage straddles plates, permitting simultaneous welding on both sides of the double-beveled joints.

A 900-amp, d-c engine-drive welder provides power for automatic welding operations. Welding wire is ⅛ in. in diameter, and wire feed speed ranges from 7 to 24 in. per minute, depending on plate thickness.

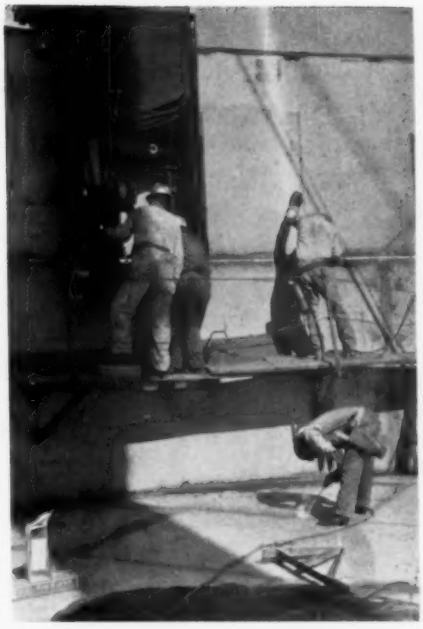
Intercom Connection

Submerged-arc operators, separated by thick plate in the course of their work, are equipped with an intercom system to help coordinate welding operations.

All welds on the water storage tank —which is 102 ft in diameter, 80 ft high, and is mounted on a thick concrete base—are spot-checked by a portable X-ray unit. The 175-kvp machine can be set up wherever desired in the work area by a crew of two or three men. Film is held against welded seams by magnetic clamps.

The tank roof will be unsupported. Gussets will be welded in place at points along the outer rim of the roof, but the cap will not be braced in any way.

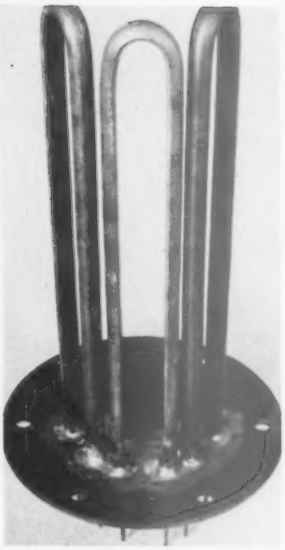
OUTSIDE *(left)* and inside work on horizontal seams is quickly done with automatic submerged-arc field unit. Note earphones on operator at left; intercom system helps coordinate work on either side of plate that is over 1 in. thick. Gas flame precedes welding heads to dry out beveled joint and give minor preheat.



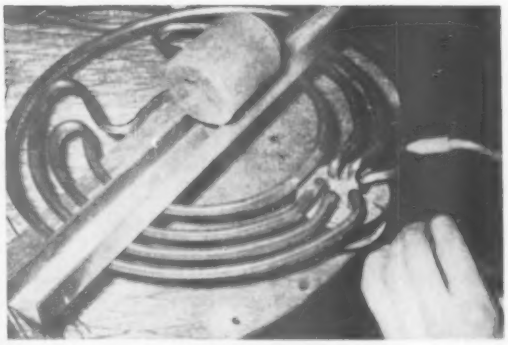
SPOT-checking seams with this portable 175-kvp X-ray unit insures sound welds throughout structure. Film is held against outside of seams by magnetic clamps. X-ray unit can be placed close to seams and does not interfere with normal progression of work.

FROM the bottom . . .

. . . UP, vertical seams must be manually welded. Plates are welded on outside first, then back-gouged with arc-air torch before final passes are made on inside seam. Weldors use 5/32-in. low-hydrogen E7016's, and specifications call for six passes, including cover beads.



LEFT: U-shaped heating elements containing electric resistance wires have been brazed to steel supporting plate.



ABOVE: High-silver, low-melting-point alloy economically joins stainless tubes to brass plug. The completed heating element, shown at left, is completed in 5 minutes with oxypropane torch.

The proven advantages of brazing in high-production situations are cited by the authors through actual examples presented in this article. Be sure to read Part 1 in the October issue of Welding Engineer.

Brazing for greater productivity

By G. M. A. Blanc and Rene D. Wasserman

DEPENDING ON THE TYPE of assembly, number of items to be repetitively manufactured, and available means, every type of heating method may be employed in production brazing.

This would include acetylene, butane, propane or illuminating gas; electric or gas ovens; ovens heated with liquid or solid fuel, with or without reducing atmosphere; high or low-frequency induction; resistance heating; salt bath, and others.

A wide alloy variety is available to the user. His final choice in each particular case, however, is based on economic and technical considerations discussed in the first part of this article (WELDING ENGINEER, *October, p. 42*). To more clearly indicate the practical ramifications of this choice, this article will outline several examples of actual production brazing jobs.

The first example illustrates the use—for three different parts of the same apparatus—of a high-silver alloy for which three different heating methods were used. The finished product is a circulation pump for central heating systems in which the squirrel-cage rotor, pump wheel, and protecting cover in which the rotor turns are brazed.

36 Wire Holes

The squirrel-cage rotor consists of a sheaf of dynamo laminations mounted on a tube acting as a hollow shaft, each face of which terminates in a copper short-circuiting disc. Arranged to take copper wires forming the bars of the cage are 36 holes.

The wires are cut long enough to overlap short-circuiting discs by 1 or 2 mm. Assembled and fluxed rotors are placed with the shaft vertical in a circular electric oven where they are heated to 1,112 F.

Rotors are removed from the oven at a rate of 10 to 12 pieces hourly, and laid on a turntable where wires and discs are brazed together with a torch using a Cu-Zn-Ag-Cd alloy with high-silver content. This fluid alloy has a low melting temperature (about 1,157 F).

A welding rod 3 mm in diameter is used, with consumption about 7 gr per rotor. After cleaning and machining to a correct outer diameter, rotors are ready for assembly.

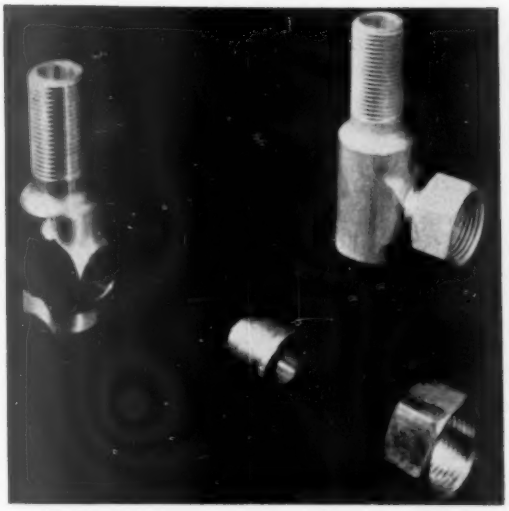
Brazed Wheel

A pump wheel formerly cast from a bronze slug is now made in two parts which are hot-stamped and assembled by brazing. By using the same alloy employed for rotors, all brazing is done in the oven.

The two parts are shaped so they will center themselves on one another. After fluxing blade edges, one part is laid on the other and a piece of alloy 15 mm long and 1.5 mm in diameter is placed against each blade on the outside, amounting to 1.2 gr per wheel.

Parts are then oven heated to 1,335 F and removed at a rate of 30 per hour, ready for finishing. Brazed joints are situated at the bottom of the blades. Accurate duct shaping could not have been achieved with such precision at a foundry.

Since this type of circulation pump is not provided with a stuffing box,



AUTHORS point out that components of this water tap unit could not have been manufactured in their present shape without the aid of brazing. Completed unit is in background.

a cover stamped from a thin sheet of austenitic stainless steel is inserted between rotor and stator of the electric motor. Play between cover and rotor is minimized by a stainless centering bushing placed inside the bottom of the cover.

The centering bushing, after fluxing, is set under the cover together with a ring of filler metal made from 2-mm-diameter alloy. The bushing is centered exactly with a jig. Parts are then arranged on a turntable with the open side up. Heat is applied with an illuminating, gas-compressed air burner.

Stainless Elements

Filler metal of the same quality used for the other two parts is drawn by capillary action between the bottom of the cover and the bushing collar, forming a fillet joint outside the collar and inside the socket. Filler metal consumption is 4 gr per part, and production rate is 20 parts an hour.

Another example where a high-silver, low-melting-point alloy is used is in the illustrated heating elements. Parts are stainless tubes in which electric resistance wires are inserted. A special sand insures adequate insulation.

These sealed units are easily bent and can be fitted into narrow spaces with complicated shapes. To insure that outlets are watertight, the tubes are brazed into plugs or supporting plates.

The supporting plate for the vertical unit is steel; the plug in the element being brazed is brass. In both cases, brazing is done with a propane torch, and the six assemblies are made in about five minutes, using 1 gr of alloy per outlet, a total of 6 gr per element.

In brass foundry work, greater use is being made of opportunities afforded by brazing in simplifying cast or stamped parts and combining them with drawn or milled parts.

Brazing: the Only Way

Components of the water tap unit illustrated could not have been manufactured in this shape without recourse to brazing. In the foreground is the tap body of stamped and milled brass, and the collar bushing and nut, both cut from round or hexagonal brass bars. In the background is a completed unit.

This job is done by high-frequency induction heating. A ring of 1.5-mm-diameter filler wire with high-silver content is fluxed and placed on the bushing, then inserted in the tap body. The part is placed inside the induction coil, with a spring pin pressing the bushing against the tap body so that it will be pushed home when filler metal melts.

Actual brazing time is 30 seconds. Despite the very small amount of alloy used (0.7 gr per part), a perfect fillet is produced. Testing at 12 atmospheres resulted in a very small reject ratio.

Steel furniture manufacture is an outstanding example of an industry that owes its remarkable expansion almost entirely to brazing. Restricted at first to a few specialized applications, steel furniture is found everywhere today: gardens, offices, schools, theaters, hospitals, factories, and even in the living room.

As a classic example, some items of garden furniture with steel tube frames have been selected. The elements of steel tubing are shaped, usually by cold bending, and positioned on a jig. The jig is designed so that all joints can easily be reached, since all assembly operations must be completed before the finished item is removed from the jig.

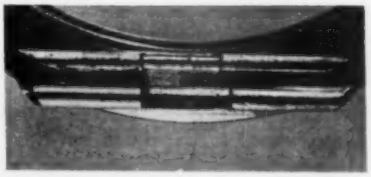
Torch Brazing

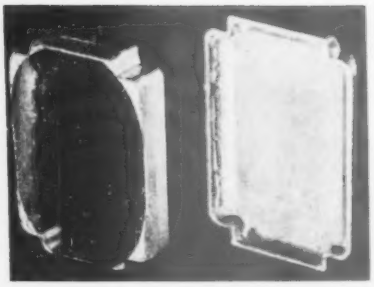
Assembly of a chair comprised of 10 brazed joints is done with a highly-fluid Cu-Zn-Ni alloy with a tensile strength of about 50 kg per sq mm. Joints are coated with flux and brazed with a 3-mm-diameter flux-coated alloy and an oxyacetylene torch. Total brazing time per chair is 12 minutes, including set-up time on the jig, and 16 gr of filler metal is used.

A bench illustrated in the first part of this article demands substantially more work because of its size; larger tubing is needed to insure permanent rigidity. The sequence of operations remains the same, but each bench requires 24 brazed joints, taking about 45 minutes (including set-up time), and using 50 gr of alloy.

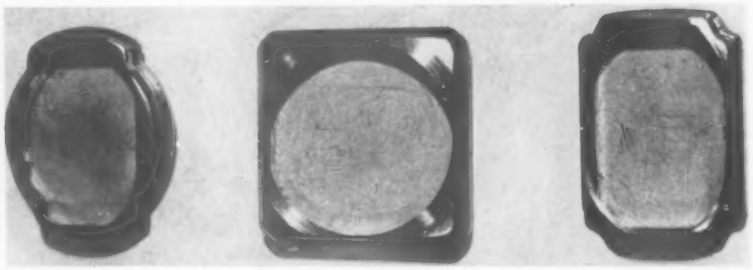
An industry involving much smaller

FOUR small tubes comprise stem mount and hinge for this pocket watch case. They are brazed to rim in an oven. Close-up *(below)* shows neat brazing job on hinge.





LEFT: Only 1 or 2 gr of brazing alloy in strip form is needed to join shells and backs of 100 wristwatch cases like this.



RIGHT: Examples of various sizes and shapes of wristwatch cases which can be quickly and economically brazed.

parts, and where delicacy and precision of the brazing operation assumes great importance, is the manufacture of watch cases. (We refer only to large-scale production work in which the number of brazing operations in an oven may amount to as many as 400 or 500 pieces hourly. Smaller-scale manufacturing, as with gold watches, also involves brazing. But this is comparable in scope to jewelry manufacture, an artisanal trade.)

For ordinary watch case manufacture, stainless steel and German silver are base metals most commonly used. Depending on the size of a production run, the type of operation and equipment available, brazing is done either with a gas torch or in an oven with reducing atmosphere.

The brazing of German silver (nickel-silver) is generally done with a very fluid Cu-Zn-Ag-Cd alloy with high-silver content and a melting point of about 1,157 F using either gas flame or oven as heat source.

Good Color Match

Stainless steel is usually brazed in an oven with reducing atmosphere. A higher temperature is necessary to insure perfect cleanliness of the parts. For this reason, alloys with higher melting points are selected. These alloys usually have a Cu-Zn-Ag-Ni base, giving them a white color—an excellent color match for stainless steel.

Although the pocket watch has been superseded to a great extent by the wristwatch, an illustrated example of the former is interesting from the point of view of brazing. The stem mount and hinge—four small tubes —are brazed to the rim in an oven (with reducing atmosphere) in a single operation at a rate of 200 pieces an hour. Parts are German silver and the alloy used is a Cu-Zn-Ag-Cd type.

The remarkably accurate flow requires no further cleaning or finishing. Parts are bright when they leave the oven.

Wristwatch cases are made in two parts: shell and back. For designs such as these, parts are fitted together and torch or oven brazed.

Irrespective of which heating method is used, filler metal in strip form is placed inside the case against one of the sides. Melting, it fills the joint between the two parts so well it is almost beyond direction. The two parts are so perfectly adjusted that only one or two gr of filler metal are required to assemble 100 cases.

On an hourly basis, torch output amounts to about 300 cases. In a continuous oven, 400 to 500 wristwatch cases per hour can be produced. Lugs or loops to which the strap is attached are brazed to the rim. A gas torch is used for this application because of the difficulty in keeping lugs positioned exactly.

These cases can generally be produced at about 150 parts an hour with very low alloy consumption.

SPECIAL jig holds cold-bent steel tubing in chair form for brazing. All 10 joints are accessible and total time per chair is 12 minutes (including set-up).

Substitute Brazing

The final example shows that, in some situations, considerable advantages are derived from replacing fusion welding with brazing. This can be true, even when using a high-silver filler metal with a relatively high unit price.

It required 20 man-hours of fusion welding to produce a railcar water tank made of brass sheet. This included necessary time spent straightening parts distorted by high fusion-welding temperatures. Now, by brazing the tank with a high-silver alloy with a melting point of about 1,157 F, assembly time is reduced to 2½ hours. No machining or finishing is required.

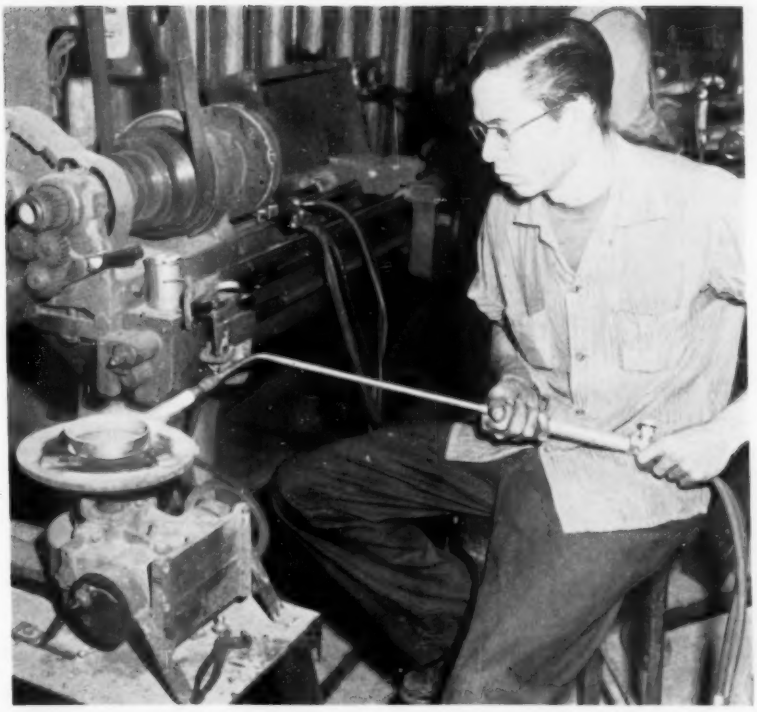
Despite the cost of the 450 gr of high-silver alloy used, the 17½ man-hours saved cut total assembly costs in half.

These examples should prove that, for manufacturing problems of different types, brazing fulfills both technical and economical requirements involved. High-quality filler metals enable successful solution of numerous production problems at reduced cost.

The simple preparatory work required and great accuracy of execution, as well as elimination of subsequent finishing operations and the scope afforded for large-scale series manufacture, make brazing a technique of prime importance for higher productivity.

Flame spray fights wear and corrosion

By Hoyt Todd
Vice President and Metallurgist
Western Carbide Corp.
N. Hollywood, Calif.



HEAT from torch is applied to wear rings for use in oil fields. Hardfacing here increases unit longevity and resistance to corrosion.

INCREASED DEMANDS from industry for materials having greater resistance to abrasion, corrosion and oxidation have led to considerable research by many interested firms.

Western Carbide's studies have focused on a composition in which two materials are combined to give better wear qualities than either material used separately.

Use of the flame spray process in applying low-melting-point alloys (Ni-Cr-Si) to a base metal, and braze-bonding them, forms such a composite material. By this method, base material may be chosen—or altered—to meet requirements, and a highly abrasion-resistant material is placed on the surface.

There are two product types now being produced by Western Carbide for use with the flame spray process: an alloy suspension in paste, and one in powder form.

It must be understood that flame spray is different from conventional metallizing, in which a wire is fed into a flame and molten material is projected onto a roughened surface. It differs in these respects:

(1) Melting points are low and are limited to nickel-base alloys.

(2) Because of their hardness, these materials cannot be supplied as wires, but only as powders which are blown through an oxyacetylene flame and impinge on the base metal.

(3) The sprayed coating is fused and brazed to the base metal. Thus, coating reaches maximum density and becomes an integral part of the base metal.

Engineering Properties of Ni, Cr, Si, B and Fe

Alloy	Nickel, Chromium, Silicon, Boron, Iron
Melting point	1,850 F
Coefficient of friction	Against Steel 0.237 Bronze 0.222
Oxidation resistance	Excellent to 1,750 F
Corrosion resistance	No attack in salt water, steam and atmospheric media. Resistant to most mild and diluted acids.
Coefficient of expansion	8.3 x 10.6 in. per inch per deg F
Hot hardness	Will retain over 90% of room temperature hardness at 800 F and over 85% at 1000 F

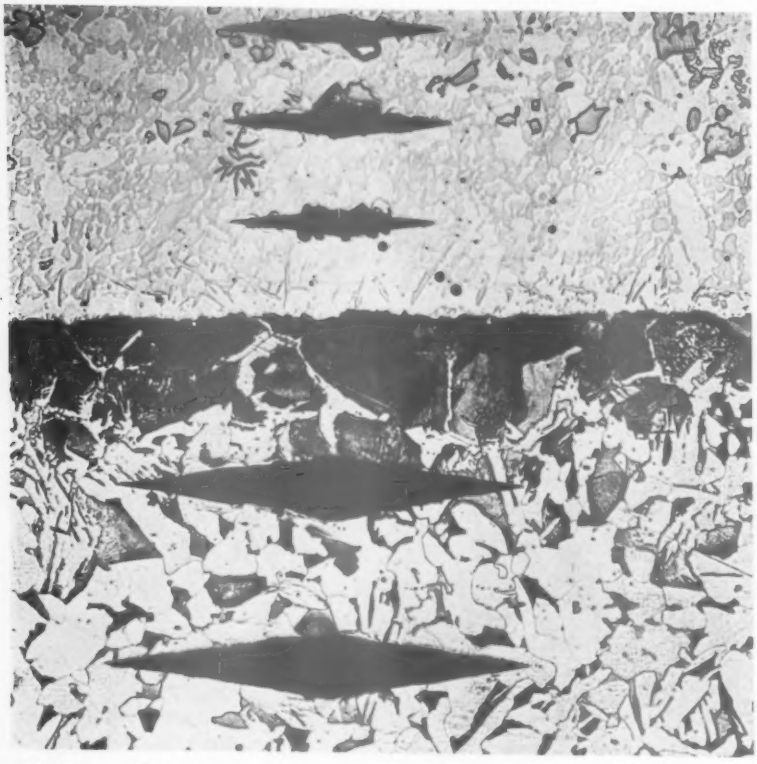
Procedure

There are four steps in the fusion process: surface preparation; masking of areas where no coating is desired; coating application, and fusion. Application and fusion may be carried out in the same operation.

Surface preparation is done by grinding, or by machining the area to be hardfaced. Surface measurements must be less than desired finished dimensions to allow for coating thickness.

If machined, a thread of 80-160 per in. should be cut or the surface should be knurled. This will give required roughness. When machining is not feasible, the 125-150 micro inches of roughness may be obtained by grit blasting with metallic abrasives. (Non-metallic grits are not recommended as they imbed themselves in the surface and hinder proper bonding.)

No dirt or grease should remain



NOT diamonds in the rough, but a microphotograph showing Knoop hardness indentations. Parent metal is on bottom of the photograph.

grease is present, it should be removed with a solvent—carbon tetrachloride or trichlorethylene. Solvents must be completely removed before flame is applied, since they form chlorides and prevent good alloy adherence.

After the surface has been prepared, areas not to be coated are masked either with a special ceramic paint developed for this application, or with glass or aluminum tape backed with a silicone adhesive.

The area is now preheated to 250-350 F to prevent water condensation by the torch. This completed, the alloy is sprayed evenly to a thickness 30% greater than desired. Shrinkage during fusion, and stock removal when finishing, dictates this seemingly heavier-than-necessary coating.

Fusion is facilitated by heating the *base metal* before or during application of heat to the coating. If the coating is heated to fusion temperature before the base metal is heated, it will melt and coalesce without bonding.

Furnace, torch or induction heating methods may be used to achieve fusion. Induction heat is ideal because heat is transmitted to the coating through base metal—thus, base metal reaches bonding temperature before fusion of the sprayed alloy takes place.

Torch heat, however, is most commonly used, and gives excellent results if properly applied. The torch should begin heating at a point adjacent to the sprayed coating, or, if this cannot be done, at the center of the sprayed area.

HARDFACING is applied to this pump plunger, used in oil fields. Added material prevents pumping operations from reducing the cross section.

Fusion

As fusion begins, the sprayed area assumes a glossy appearance. The torch is slowly advanced over the remainder of the coating until fusion is complete.

Application errors can be corrected by reheating the coating to a plastic state (1,800 F) and removing material with a file or a piece of cast iron welding rod.

These nickel-base spray powders are produced in hardness ranges of 40, 50 and 60 Rockwell C. (Material of 40 and 50 Rockwell C hardness may be machined with carbide tools at light feeds and slow speeds. Materials with a hardness rating of 60, however, must be ground to final dimensions.)

Base metals may be heat treated after being coated only if upper critical temperatures are below 1,800 F. Also, if the area to be coated is large or the coating is over 0.060 in. thick, a hardness of 40-50 Rockwell C is recommended to prevent cracks during quenching.

Metal Selection

Selection of base materials is limited only by the fact that they must have a melting point above that of the coating (1,850 F). This will forestall any melting of base material.

These alloys are widely used in the petroleum, chemical and aircraft industries because of their high resistance to abrasion, corrosion and oxidation.

The table included in this article indicates the engineering properties of this alloy family.

Here's the first article in an informative two-part series which relates each applicable welding process to . . .

Factors that shape the weldability of aluminum bus

GAS welding of aluminum bus bars is thoroughly treated in this installment. Part II, to be presented in the December issue, will cover various arc welding processes.

CHARACTERISTICS of aluminum and aluminum alloys that influence their weldability are these:

(*1*) melting point and thermal capacity;
(*2*) thermal conductivity;
(*3*) oxidation;
(*4*) gas porosity;
(*5*) thermal expansion and contraction, and
(*6*) effects of welding on mechanical and electrical properties.

An understanding of these characteristics as they apply to fundamental welding principles is essential when establishing sound practices for welding aluminum bus bars.

Melting Point

Pure aluminum melts at 1,020 to 1,220 F, depending upon the amount of alloying constitutents present. There is no color change in heated aluminum.

In gas welding, therefore, an inexperienced weldor finds it difficult to avoid melting and sagging. Arc welding lessens troubles encountered in overheating.

Specific heat of aluminum on a unit-weight basis is high, so despite its relatively low melting point, equal weights of aluminum and steel will require equal heat input for an equivalent degree of melting.

Aluminum conducts heat from the point of welding very rapidly, however, so it demands more welding heat than does steel.

Aluminum and its alloys rapidly develop a continuous oxide surface film when exposed to air. This film is tenacious and has a melting point in excess of 3,600 F.

Aluminum will melt, but the oxide film will not fuse. Coalescence obviously cannot take place because the metal will not flow freely. The oxide film, therefore, must be removed or broken down by a chemical flux or by mechanical abrasion.

In gas and arc welding, fluoride and chloride fluxes of lithium, potassium and sodium combine chemically with the oxide to form compounds with melting points lower than aluminum. These fluxes harden over weld metal to prevent further oxidation while metal is hot.

Chloride and fluoride salt residues left by flux in gas welding will attack aluminum in the presence of moisture. Thorough cleaning *must* remove all traces of flux after welding is completed.

Fluxes for gas welding usually are mixed with water to form a paste which can be brushed on welding surfaces before heating. Paste can also be applied to the filler rod during welding. Arc welding electrodes, of course, carry flux in their coating.

(A major advantage of inert-gas-shielded welding processes is that they do not require the use of fluxes. Action of the welding arc breaks up the oxide film and permits coalescence of filler and parent metal.)

Gas Porosity

Molten aluminum readily absorbs large amounts of nascent hydrogen, but releases much of it in cooling because the solubility of hydrogen in solid aluminum is very low. This released hydrogen produces porosity in the weld and may impair weld properties.

Hydrogen may be introduced into a molten weld by

This article is based on a chapter from the "Kaiser Aluminum Electrical Bus Conductors Technical Manual," which was published in September and is now being distributed.

moisture from various sources, such as aluminum bus surfaces; welding rods; fluxes; the gas flame, or from the atmosphere. To reduce incidence of porosity, each of these items should be carefully checked to eliminate moisture.

Aluminum alloys for bus bars are of two types: work-hardened alloys, such as EC and 1100, and such heat-treatable alloys as 6101 and 6063. Strain or work-hardened alloys are hardened and strengthened by such processes as cold-rolling or drawing.

Cold-worked alloys lose part, or all, of their increased hardness and strength when heated to a high temperature. Degree of loss is a function of time and temperature; however, at temperatures above 900 F, the time interval is almost negligible.

Therefore, as a result of welding, mechanical properties of a bus joint are reduced to typical properties of an annealed parent bus.

Aging Treatment

Heat-treatable alloys retain improved properties over those in a typical annealed condition by solution heat treatment at elevated temperatures—about 900 F. This treatment is followed by a low-temperature (approximately 300 F) aging treatment to precipitate certain alloying constituents.

When these alloys receive high welding temperatures, strength is decreased in a ratio to welding time and maximum temperature. Resulting strength, however, is still higher than that of the annealed bus.

Electrical conductivity of heat-treated or work-hardened alloys is improved slightly during welding if enough heat is introduced to partially anneal bus material. This increase in conductivity is greater for heat-treated and aged alloys than for work-hardened alloys.

Joint design and edge preparation for welding are modified to suit material gage and the joining process used. On thin-gage materials (1/16 to ¼ in. thick), a square butt joint is usually satisfactory for all processes. In heavier gages, either single- or double-vee edge preparation may be necessary.

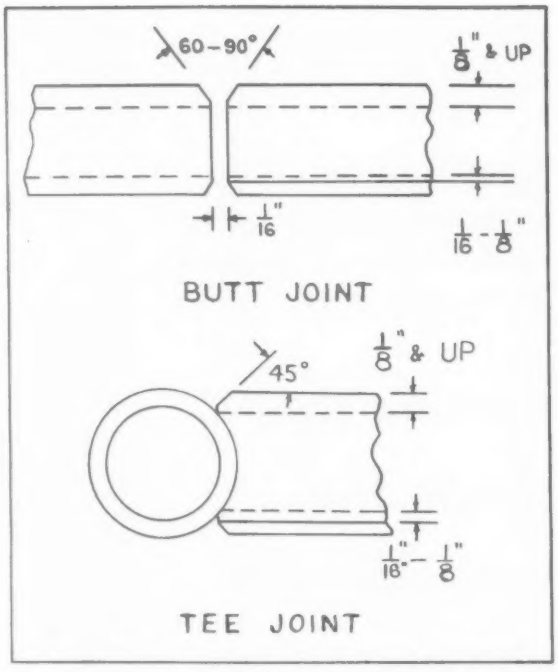
Gas welding usually requires greater edge preparation than metal-arc processes. Back-up plates are recommended wherever possible to control weld penetration.

Cleaning Welding Surfaces

Cleanliness is of major importance in welding aluminum, regardless of welding process used. Heavy grease or oil films picked up during fabrication may cause unsound welds if not removed.

RECOMMENDED FILLER RODS
FOR WELDING VARIOUS BUS ALLOYS

Bus Designation	Recommended Rod
EC	EC or 1100
1100	1100
55 EC (6101)	4043
56 EC (6101)	4043
57 EC (6101)	4043
6061	4043
6063	4043



EDGE preparation for gas welding tubular aluminum bus. Backup is not recommended for these sections. Edge preparation on channel conductors and hollow rectangular bus depends on wall thickness, and is similar to that for flat bus of comparable thickness. Bevel, however, is about 15 deg greater.

Milky alkaline solutions or commercial degreasers that do not emit toxic fumes during welding are used successfully to remove surface contaminants before welding. All surfaces should then be dried to avoid porosity in weld metal.

Preheat is necessary when thickness or mass of a bus conducts heat away from the joint at a rate faster than that of heat input during welding. Insufficient preheat will cause poor weld bead fusion and insufficient melting of parent metal.

Choice of Welding Method

Choice of a process for welding aluminum bus bars is influenced by these factors:

(1) physical dimensions of parts being joined;
(2) number of joints to be made;
(3) equipment available;
(4) welding site (whether field or shop) and power sources available, and
(5) cost.

Welding equipment designed for joining ferrous materials, although not always the most suitable for welding aluminum, is often utilized where only a few welds are made and cost per weld is not critical. Where larger-scale production must be done, however, specialized equipment will soon justify its purchase price.

Availability of portable electric welders makes field fabrication feasible when employing an arc welding process. Gas welding is the alternate method where arc welding equipment is unavailable.

A number of common welding methods may be used on aluminum and its alloys. These include gas welding, and

the arc welding processes of manual metal-arc, Mig, Tig, carbon-arc and atomic-hydrogen.

Gas Welding

Gas welding is most widely used on aluminum where only a few welds are made and capital outlay for equipment must be kept to a minimum. This process also finds wide application in field operations where electrical power is not available for arc welding.

EC aluminum and its alloys are often gas welded with mixtures of oxygen and such fuel gases as acetylene, hydrogen or propane. An oxyacetylene mixture is most widely used because of its high heat output and its availability.

Oxyhydrogen is second in popularity; weld quality is equally good with either gas mixture. Oxypropane and oxy-natural gas mixtures have been used to weld aluminum, but they result in slower welding speeds.

Apparatus used for gas welding aluminum is similar to equipment used for other metals. Standard welding torches, hoses, gas regulators and a series of torch tips are required.

Size of tip used for joining bus bars will depend on metal thickness and, to some extent, on the weldor's experience. Gas pressures increase in a ratio to bus bar cross-section.

Gas Flame Adjustment

Pressure used for either oxyhydrogen or oxyacetylene gases should be adjusted to produce a neutral or slightly reducing flame. Both flames produce a clean weld with the best combination of welding speed and gas economy.

A neutral oxyhdrogen flame is a well-defined blue cone. An excess of oxygen causes a small flame with a very short cone at the torch tip. Excessive hydrogen produces a long ragged flame with no well-defined cone.

The oxyacetylene flame can be varied in a manner similar to that of an oxyhydrogen flame. A neutral flame is secured by reducing acetylene pressure until only one white cone is visible at the center of the flame. Slight acetylene excess produces a reducing flame and molten aluminum suffers less oxidation with this mixture.

Filler materials for gas welding are commercially available as bare or flux-coated rod. Strips cut from parent metal may also be used as filler. Whenever bare rod is used, a flux must be applied to the rod before welding.

Proper choice of filler metal will depend upon the alloy being joined. Metals of high purity, such as EC or commercially pure aluminum (1100 alloy), are usually welded with EC or pure aluminum rods.

Bus alloys 6061, 6063 and 55 EC are usually welded with a 95% Al, 5% Si alloy—4043. The 4043 alloy has a substantially lower melting point than alloy 1100 and permits good weld fusion.

It also minimizes weld cracking tendency as it cools. Other commercial filler rods containing magnesium, such as X5356 and 5154, may also be used for welding 6061.

Size of filler rod is related to thickness of the bus being welded. A rod that is too large will prevent a weldor from seeing the weld pool, and makes welding difficult.

Preheating

Preheating a bus bar improves gas welding by increasing welding speed, reducing distortion in the finished joint, and cutting down gas required to make the weld.

Bus sections thicker than 3/16 in. should be preheated to 600-700 F. Preheating above 800 F is undesirable because there is danger of melting some alloying constituents. Heat should be applied uniformly to both parts being joined.

Preheat temperature of the bus can be checked with temperature-sensitive crayons or a pyrometer adjusted for measuring temperature of aluminum.

Edge Preparation

To produce sound welds with good mechanical properties, welding edges must be properly prepared.

Overlay joints are not recommended for gas welding

COMPOSITION PERCENTAGES FOR
BUS BAR AND FILLER ROD ALLOYS*

Element	EC	1100	6063	4043	6101 (55, 56 & 57 EC)	6061
Silicon			0.20-0.60	4.5-6.0	0.30-0.70	0.40-0.80
		1.00				
Iron			0.35	0.80	0.50	0.70
Copper		0.20	0.10	0.30	0.10	0.15-0.40
Magnesium			0.45-0.90	0.05	0.35-0.80	0.80-1.20
Manganese		0.05	0.10	0.05	0.03	0.15
Zinc		0.10	0.10	0.10	0.10	0.20
Chromium			0.10			0.15-0.35
Titanium			0.10	0.20		0.15
Other Elements		0.05 ea.	0.05 ea.	0.05 ea.	0.03	0.05 ea.
Other Elements		0.15 tot.	0.15 tot.	0.15 tot.	0.10 tot.	0.15 tot.
Boron					0.06	
Aluminum	99.45	99.00	remainder	remainder	remainder	remainder

**All elements shown as a single percentage above are maximum allowable. The aluminum percentage shown is minimum allowable.*

TIP SIZE AND GAS PRESSURES FOR GAS WELDING VARIOUS ALUMINUM THICKNESSES

	Oxyacetylene			Oxyhydrogen		
Metal Thickness	Orifice Diameter	Oxygen Pressure	Acetylene Pressure	Orifice Diameter	Oxygen Pressure	Hydrogen Pressure
0.020 in.	0.025 in.	1 psi	1 psi	0.035 in.	1 psi	1 psi
0.032	0.035	1	1	0.045	1	1
0.050	0.055	2	2	0.065	2	1
0.080	0.065	3	3	0.075	2	1
1/16-3/16	0.075	4	4	0.095	3	2
1/4	0.085	5	5	0.115	4	2
5/16	0.085	5	5	0.115	4	2
3/8	0.095	6	6	0.125	5	3
1/2	0.100	7	7	0.140	8	6
5/8	0.105	7	7	0.150	8	6

because there is danger of flux entrapment. Wherever possible, the joint should be designed for a butt weld. If an overlap is made, welding should completely seal the edges of the overlapped area. Tubular sections require edge preparation similar to that on flat bus, but the bevel angle should be slightly larger.

Proper alignment of abutting edges may be aided by tack welding at intervals along the seam. On bus bar 1/4 in. and up, tack welds may be spaced 3 to 7 in. apart, depending upon seam length.

Grease and oil may cause unsound welds and should be removed from edges prior to welding. Commercial degreasing agents are available for this purpose. Fluxing should immediately follow cleaning.

Welding Flux

A large number of commercial fluxes may be used for gas welding aluminum and its alloys. Flux is usually obtained in a powdered form and mixed with alcohol or tap water to make paste of proper consistency.

Fluxes for gas welding should preferably be mixed in a glass or ceramic container. If it is necessary to use a metal container for flux, one of aluminum is preferred. Steel or brass containers will contaminate the flux.

Flux paste is applied to both filler rod and base metal. It should be heated slowly before welding to dry up moisture and prevent excessive spatter. As soon as flux fuses, filler metal should be dipped into an appropriate flux and added to the weld joint.

Welding Procedure

Only the flat position is recommended for gas welding aluminum. Vertical or overhead positions are not considered practical.

The torch should be pointed away from the completed weld, so that the flame continually heats the welding rod and the edges still to be joined. The flame is usually kept on the centerline of the weld, and is held at an angle of 30 to 45 deg from the vertical in the direction of travel.

Filler rod is introduced into the flame and the weld puddle as needed. Amount of flux used should be just sufficient to remove the oxide and maintain a clean surface. Excess flux will increase the possibility of flux inclusion and weaken the joint.

To start a weld, the flame is given a circular motion with an ever-increasing radius to heat and melt adjacent metal. The center of the flame should not touch the molten metal; it must be kept 1/16 to 1/4 in. above it. Filler should not be introduced into the flame until both edges are molten and a weld puddle has been formed.

The rod tip is held in the flame at, or below, the surface of the molten metal, and is added continually to build up a weld of desired dimensions. The puddle must never be allowed to completely solidify, and when the end of the joint is reached, a slight excess of weld metal is added to compensate for shrinkage.

Postweld Cleaning

Flux residues, which are corrosive to aluminum if moisture is present, may be cleaned from small sections by a 20 to 30-minute immersion in a cold 10% H_2SO_4 bath. Small sections can also be cleaned by a 10-minute immersion in a 5% H_2SO_4 bath at 150 F. A 10 to 20-minute bath in a solution of 10 to 50% HNO_3 can be equally effective in flux removal.

Regardless of cleaning bath used, a hot or cold water rinse should follow stock immersion in the acid.

Large bus sections which cannot be immersed for flux removal are usually cleaned with hot water or steam. Vigorous brushing is recommended when hot water is used.

Physical Properties

Weld metal in EC and 1100 aluminum bus bars will closely approximate typical tensile and yield strengths of the annealed metal. Slightly lower properties may result in porous welds or in those where flux has been trapped.

As previously noted, welding heat usually has a deleterious effect on physical properties of all aluminum alloys which have been strain-hardened or heat-treated to improve tensile properties. Such strain-hardenable alloys as EC and 1100 in all cold-worked tempers will revert to typical annealed properties when heated above the recrystallization temperature.

Heat introduced during gas welding usually causes recrystallization adjacent to the weld, so properties in this area will be that of the fully annealed metal. If filler metal has a strength at least equal to that of annealed bus material, the weld will support the same mechanical load as parent metal adjacent to the weld. Maximum design stresses for welded EC and 1100 bus must therefore be based upon properties of the annealed bus material.

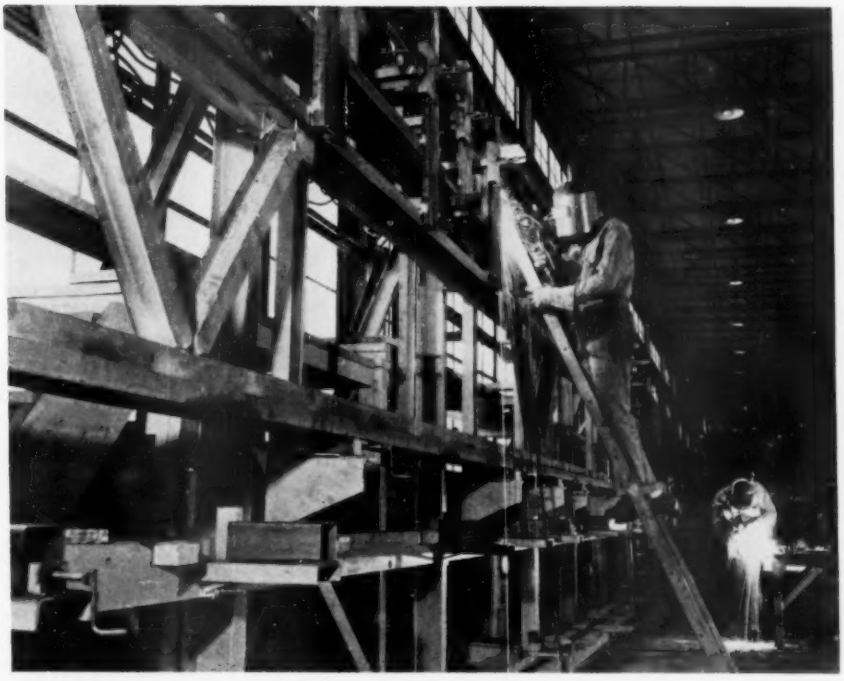
Electrical resistance of a gas welded joint approximates that of annealed filler metal. A slightly lower conductivity results where an unsound weld is encountered.

Heat-Treatable Alloys

Heat-treatable alloys derive improved physical properties through solution treatment and aging at elevated temperatures for specified lengths of time. When these alloys are reheated to the high temperatures encountered in gas welding, their properties are also affected.

Aluminum alloys 6061 and 6063 will decrease in strength appreciably. Properties of parent metal adjacent to the weld are generally lower than weld metal properties. These lower properties in small bus parts may be improved by postweld heat treatment. Larger bus bar sections do not lend themselves to such heat treatment.

A big "fix" for faster welding



ASSEMBLY and welding time has been cut nearly 60% with aid of 45-ft fixture, which clamps structural members for tack welding. Plating machine carriage is removed from fixture in one piece and finish welded *(below)* on the shop floor.

THE EQUIPMENT DIV. of Wagner Bros., Inc., can thank a giant welding fixture for reducing its manpower requirements 33%, and cutting assembly and welding time 50 to 60%.

Wagner's "icing on the cake" is the fact that accuracy of repetitive operations has been upped to 100%!

Before the Detroit firm installed the 45-ft giant—which holds pre-cut structural members for automatic plating machines—the joining operation was a "four-man trial-and-fit" job. Steel members usually were laid out on an uneven floor. Jacks then held the uprights while 44 to 50 man-hours were absorbed in squaring beams, stringers and uprights.

No More Headaches

"Today," says Plant Manager Ray Nolf, "the leveling headache is gone. The fixture handles this job automatically. Required structural members (there are 65 in a typical 30-ft carriage) are simply loaded, positioned, clamped and tack welded."

The job that once took up to 50 man-hours for the typical carriage cited by Nolf now consumes just *14*.

Plating machine carriages in lengths of 10 to 45 ft can be handled by the fixture. Carriage cross-members are located by means of pins which are vertically adjustable in 3-in. increments. Weldors work directly from lofts supplied by Wagner's engineering dept., so there is no problem in lining up carriage stations.

Layout on Floor

These stations are numbered on the lofts to coincide with similar numbers on the fixture. So, regardless of the number of carriages assembled, all are identically accurate.

Finish welding could be done on the fixture, but Wagner's procedure calls for layout of the tack-welded structure on the floor for this operation. There is an economical reason for this seemingly unnecessary move: it permits faster downhand welding.

For tack welding, weldors use a 1/8 or 5/32-in. mild steel electrode. Finish fillet welds are made with a 5/32-in. iron-powder type.

WITH tack welded mold board assembly in position on fixture, automatic submerged-arc welding head runs along beam track to join several longitudinal seams.

The construction equipment industry has found that . . .

Hard-working parts need joints that are weld-tough

By Terry Long
Gar Wood Industries, Inc.
Findlay, Ohio

ARC WELDING is the principal method used today in the fabrication of many assemblies for both light and heavy construction equipment.

The manual and submerged-arc methods allow designers to plan for the extensive use of formed steel plates which give the structures strength and stiffness. And, best of all, properly welded joints remain tight despite hard usage.

These factors, plus the sizeable manufacturing economies effected by arc welding, give the process top rating at Gar Wood's Findlay, Ohio, plant. Its application on mold boards for tractors used in earthmoving operations give some idea of the time and labor-saving factors inherent in the process.

The mold board assembly is made chiefly from 5/8-in.-thick steel plates that have previously been formed on brakes. Formed components are tack welded, then passed along to submerged-arc stations. Since many major joints are longitudinal and parallel, they lend themselves well to fully automatic welding.

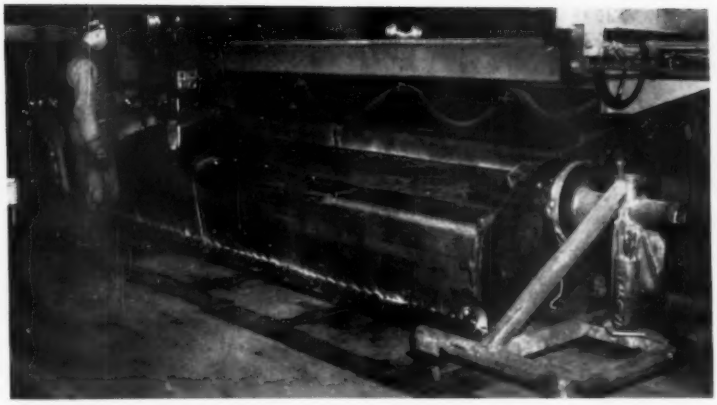
Automatic Welds

The Lincoln Electric Co. welding head on the unit pictured above is supported from a self-propelled travel carriage that runs on a heavy beam. This track is fastened with adjustable screws to transverse beams at either end of the welding fixture, and can be moved horizonally. Vertical adjustment of both beam and welding head is also possible.

To help the welding operator set the mold board at various desired angular positions, the assembly is supported in a trunnioned fixture at each end *(see photo)*. Any long side or edge of the assembly can thus be brought into a favorable welding position.

Mild steel wire, 7/32 in. in diameter, is used for automatic welding. All longitudinal seams require heavy beads, but the welding speed of approximately 11 in. per minute is high considering the large amount of metal that is deposited. The favorable speed is made possible by feeding 1,050

POSITIONED to allow use of semi-automatic submerged-arc welder (*top*), mold board also gets some manual arc welds with iron-powder electrodes.



FIXTURE holding mold board assembly is trunnioned, permitting several longitudinal seams to be brought under the self-propelled welding head. Welding speed of 11 ipm is maintained even though heavy bead must be deposited.

amp to the arc, giving high current density and deep penetration.

Current is furnished by two 600-amp d-c motor-generators. When one seam is completed, a high-level recovery unit picks up excess flux and the assembly is quickly rocked into position for the next seam weld.

30 to 50% Time Saving

When all longitudinal seams are finished, transverse stiffeners are tack welded in place and the assembly is placed in a large positioner *(see photo)*. The work positioner is used to permit application of semiautomatic submerged-arc welding.

This particular process has created time savings of 30 to 50% over that required for manual arc welding. In addition, it offers a higher current density (365 amp through 5/64-in. welding wire) which gives deeper penetration. Semiautomatic submerged-arc welding is applied to nearly all transverse welds of considerable length that can be brought into a position necessary to hold flux.

It was problems in positioning—plus the weight of a mold board assembly—that initially prompted the use of the semiautomatic process. Gar Wood has found that time saved in bringing a welder to the assembly, rather than to attempt positioning for automatic welding, has more than compensated for the slower welding speed of the semiautomatic unit.

Where fully automatic or semiautomatic welders cannot be used to advantage on mold board assemblies, joints are welded with the manual arc method. Iron-powder electrodes are used mainly in these applications, which are usually short and take very little time.

Other Applications

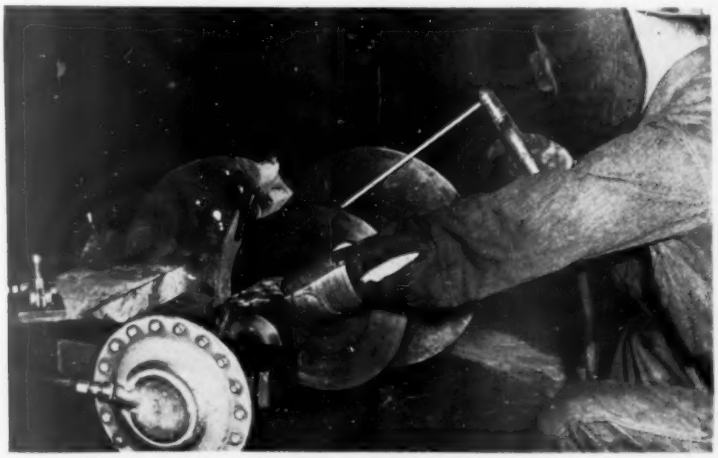
Many other assemblies are fabricated by arc welding at the Findlay plant, and not all of them are made from plate stock. One of these assemblies *(see photo)* is a plant carrier, which was originally a one-piece steel casting.

High scrap losses resulting from porosity (which was usually not revealed until machining had been completed) forced the abandonment of this casting in favor of an assembly of steel parts. Here again, however, the plant had to drop the project because welding time was excessive.

Today, this carrier is made from two steel castings. The shapes are simple and favorable for casting; scrap losses are low. When the castings have been partly machined, they are placed in a fixture and pressed together by an air-operated diaphragm clamp.

Construction of the fixture and clamp permits the weldor to rotate the assembly slowly with his left hand while using an E6024 electrode to make the circumferential weld joining the two castings.

By finding the proper combination of welding and casting in this instance, the Findlay plant is today realizing the lowest total costs of any of the three production methods they have tried.



IRON-POWDER E6024 is used by weldor joining circumferential seam on planet carrier. Part is made of two simple castings, and is held in air-operated clamp for welding.

Sealed relays with a life and reliability reported superior to many general-purpose control types have been introduced in resistance welding circuits. By using characteristics of these relays to best advantage in combination with electronic elements, says the author, the optimum in performance, circuit simplicity, flexibility and economy can be achieved in your resistance welding operations.

For high-performance in resistance welding: a new relay type

By E. B. McDowell
Specialty Control Dept.
General Electric Co.

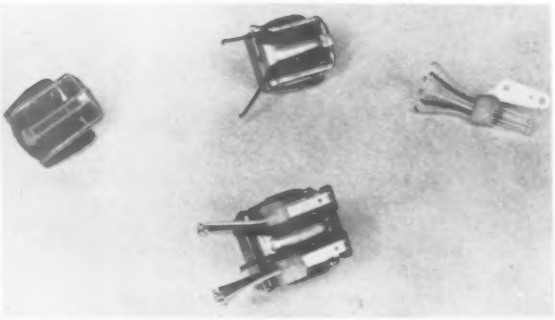


FIG. 1—Relay components contributing to high performance characteristics *(clockwise from left)*: E-frame; armature and coil assembled to E-frame; molded contact spring assembly. At bottom is an assembled relay.

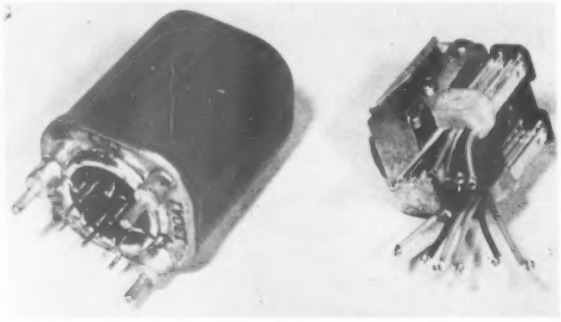


FIG. 2—This four-pole relay will control other relays and small contactors, and will perform miscellaneous switching functions in electronic circuits.

ELECTRON TUBES AND RELAYS have been basic components of electronic resistance-welding control circuits since this method of control was introduced to the welding industry.

Tubes have been used to provide timing and modulation functions where output must be varied in some relation to input, and relays as well as tubes have been used for many control and circuit-transfer operations.

In applications where either of these components could perform the desired functions, a choice was based on operating speed, life, circuit flexibility, economics, and experience gained in the field from the use of these components.

Gradual Substitution

The past history of resistance welding has seen a gradual substitution of tubes for relays, occasionally at the expense of more complex circuitry. This trend has been brought about mainly by the fact that relay performance in general has not been satisfactory in this field largely because of severe duty and environmental conditions.

General-purpose control and telephone type relays, often with unprotected contacts, were commonly used. Although satisfactory in other fields, the relays were frequently responsible for abnormal maintenance due to short life and improper operation.

This experience demonstrated the need for a relay whose life and reliability would easily meet service conditions encountered in resistance welding. Such a relay would have to be used in combination with tubes to good advantage, without concern for limiting or degrading welder performance.

Advantages of Relays

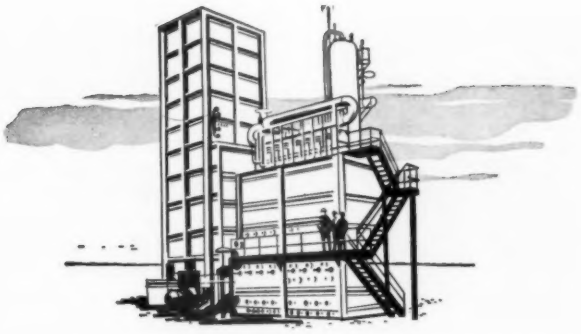
Typical relays have characteristics which enable them to perform certain functions better and with less circuit complexity than tubes or other methods. For instance:

(1) Relay contacts are a completely isolated circuit element which provide a closed-circuit resistance of a fraction of an ohm and an open-circuit resistance of many megohms. Both contacts can also be isolated by many megohms from ground or any other point in the circuit. Series and parallel circuit switching can thus be accomplished in a more simple, straightforward and economical manner than with tubes.

(2) Since relays can be provided with multiple contacts, simultaneous control of several isolated circuits can easily be achieved. This feature is probably the most important advantage over tubes, since control of isolated circuits from a single tube becomes complicated.

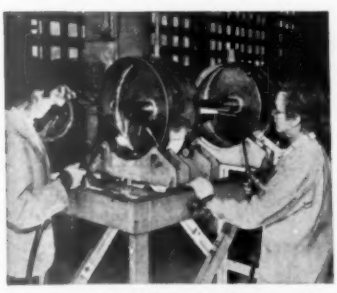
(3) Line transients, often troublesome to tube circuits, have little effect on relay circuits. Duration of the transient is usually too short and the energy level too low to operate a relay.

(4) Relay contacts can be used with a-c and d-c con-



JOIN WITH HANDY & HARMAN SILVER BRAZING FOR PERMANENT PROFIT

Joining Heat-Exchanger Tubing To a Header Ring: Brazing team joins 78 closely spaced tubes to header ring of heat exchanger. Degreasing and fluxing with Handy Flux takes place before assembly. EASY-FLO 35 is hand-fed; heating is oxy-acetylene. Two operators braze complete assembly in 35 minutes.



Brazing Tube Sheet Into Sleeve: Involves a hermetic joint between ¾ in. thick copper tube sheet and the inside wall of a copper-bronze sleeve. Operators work as a team, one face-feeding the EASY-FLO 35 wire from the front, partner heats from the back to draw molten alloy through. On some units joint is 1½ in. thick, 170 in. in circumference. Average time 30 minutes per joint.

How would *you* make 300 joints involving 6 different metals?

Air Products, Inc., Allentown, Pa., does it with silver brazing

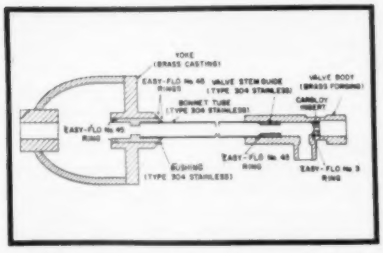
Here you have an air separator that produces tonnage quantities of oxygen and/or nitrogen for industrial uses. Its components are made of Type 304 stainless steel, cast bronze, brass, copper, copper bronze and Carboloy. Joints range in size from less than ¼ inch to 54 inches in diameter. Metal thicknesses vary from .025 to 1½ inch. In operation, the separator is exposed to temperatures of −300°F and pressures approaching 5000 psi.

Complex? You said it and when you take *everything* into consideration – range of metals, operating strength, metal thickness, joint sizes, production speed and economy – Handy & Harman silver alloy brazing is the *best* way to do it.

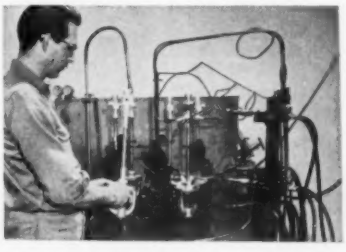
Air Products handles these multiple production problems with speed and dispatch. Illustrated are three examples.

This operation typifies the versatility of Handy & Harman silver alloy brazing. Here is one method doing a *wide variety of jobs.* It is doubtful whether any other existing method could be used to the same effect on an *assembly line basis.* It can do as much for you.

Look into Handy & Harman silver brazing. We'll work closely with you.



Six-Piece Expansion Valve Assembly Joined In One Operation: Drawing of valve assembly shows locations of 5 preplaced rings of EASY-FLO 3 and EASY-FLO 45. Rotary table silver brazes about 20 expansion valves an hour, more than three times the former rate with hand torches. Multiple burners are used to reduce heating time for the heavy brass parts. Burners can be repositioned and more burner stations added.



Bulletin 20, to begin with

This concise bulletin introduces you to silver alloy brazing—gives joining methods and joint design as well as economies that exist with EASY-FLO brazing. Just ask, we'll be pleased to send you a copy.

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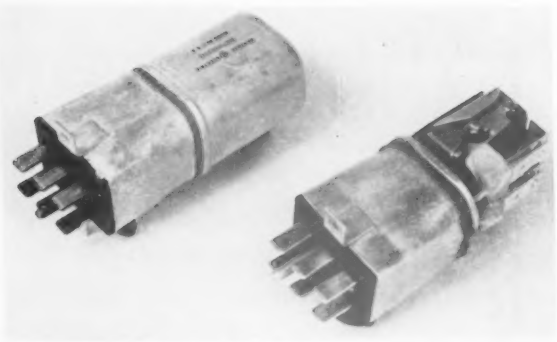


FIG 3.—With a two-pole, normally open contact arrangement, this relay is designed for control of specific loads with power requirements greater than those handled by the general-purpose relay in Fig. 2.

trol circuits. Tubes can provide off-on control with d-c or half-wave a-c, but a-c circuitry is more complex.

A relay, to meet the high performance required of a component for resistance welding service, must have characteristics superior to those of the typical control relay. Here are these essential characteristics:

Long life—Under maximum load, the relay should give a minimum of 20 million operations. With lighter loads normally encountered in many control circuits, this life should be extended to more than 40 million operations. So that mechanical life will not be a limiting factor, the relay should be capable of operating at least 75 or 100 million times at no load.

Reliability—The relay should perform consistently during its normal life expectancy.

Immunity to atmospheric effects—The relay should be sealed so that dust, foreign particles or vapors do not affect its operation.

Load control—The contacts should be capable of controlling small relays; contactors up to size 0 and direct-acting solenoid air valves; switching electronic circuits, and firing ignitor circuits. One relay would not necessarily have to handle all these loads.

Fast operation—To meet high-speed requirements of resistance welding service, a relay should be capable of being picked up in less than one-half cycle.

Now in Service

Relays which easily meet these requirements are now in use in welding control circuits. Although new in the welding field, relays of the same basic structure have seen considerable service in both aircraft and military applications.

Hundreds of thousands of these relays placed in service during the past five years have demonstrated a high degree of reliability. And although long life was not a service requirement, industrial applications and laboratory tests have shown excellent life characteristics.

Construction Features

An accurate evaluation of the relays' capabilities in resistance welding circuits has been determined from a rigorous life testing program which has been in progress for the past year and a half.

To achieve the characteristics mentioned above, a relay must be designed with an adequate margin of safety so it can be manufactured with consistent high quality without the use of skilled labor for routine operations. Here are major features *(Fig. 1)* contributing to high performance:

1—A short, heavy E-frame provides a rigid framework for mounting spring assemblies and armature, and forms an efficient magnetic structure.

2—The rocking-bearing pivot type for the armature has low friction and is well known for its long life.

3—The contact spring assemblies are molded in thermosetting compounds which provide a means of permanently positioning contact springs with uniform support across their width . . . preventing stress concentrations and possible movement relative to each other.

4—By sealing the relay to prevent contamination, electrical and mechanical life are improved and good electrical contact is assured.

5—A short-stroke, high-force magnet operates contacts through lever action of the armature to produce high tip pressure and good wipe with less than one-half watt of coil power. High tip pressure is a major factor in insuring contact reliability. Low mass of the armature, combined with the magnet, results in fast pick-up.

6—To assure maintenance of high quality standards, adjustment procedures should be used which minimize human errors. Inspection and test of all parts must be performed at various stages of manufacture.

Actual Perfomance

Two relay forms have been selected to satisfy most requirements in resistance welding circuits. One was intended for use as a general-purpose relay for low-power circuit *(Fig. 2)*, and the second *(Fig. 3)* for control of specific loads with somewhat greater power requirements.

The first relay has a four-pole, double-throw contact structure which will control relays and small contactors, and will perform miscellaneous switching functions in electronic circuits. The second relay has a two-pole, normally open contact arrangement.

This latter relay uses the same basic magnetic structure, but it is provided with larger contacts and heavier contact springs. Its primary function in welding circuits is to control direct-acting solenoid air valves of the type used on gun-type resistance welders, and to provide direct ignitron firing.

Since this relay is intended for use in 460-volt circuits, a large plug assembly has been added to secure necessary creepage. Both relays are designed for operation from a d-c source, or from a-c half- or full-wave rectification.

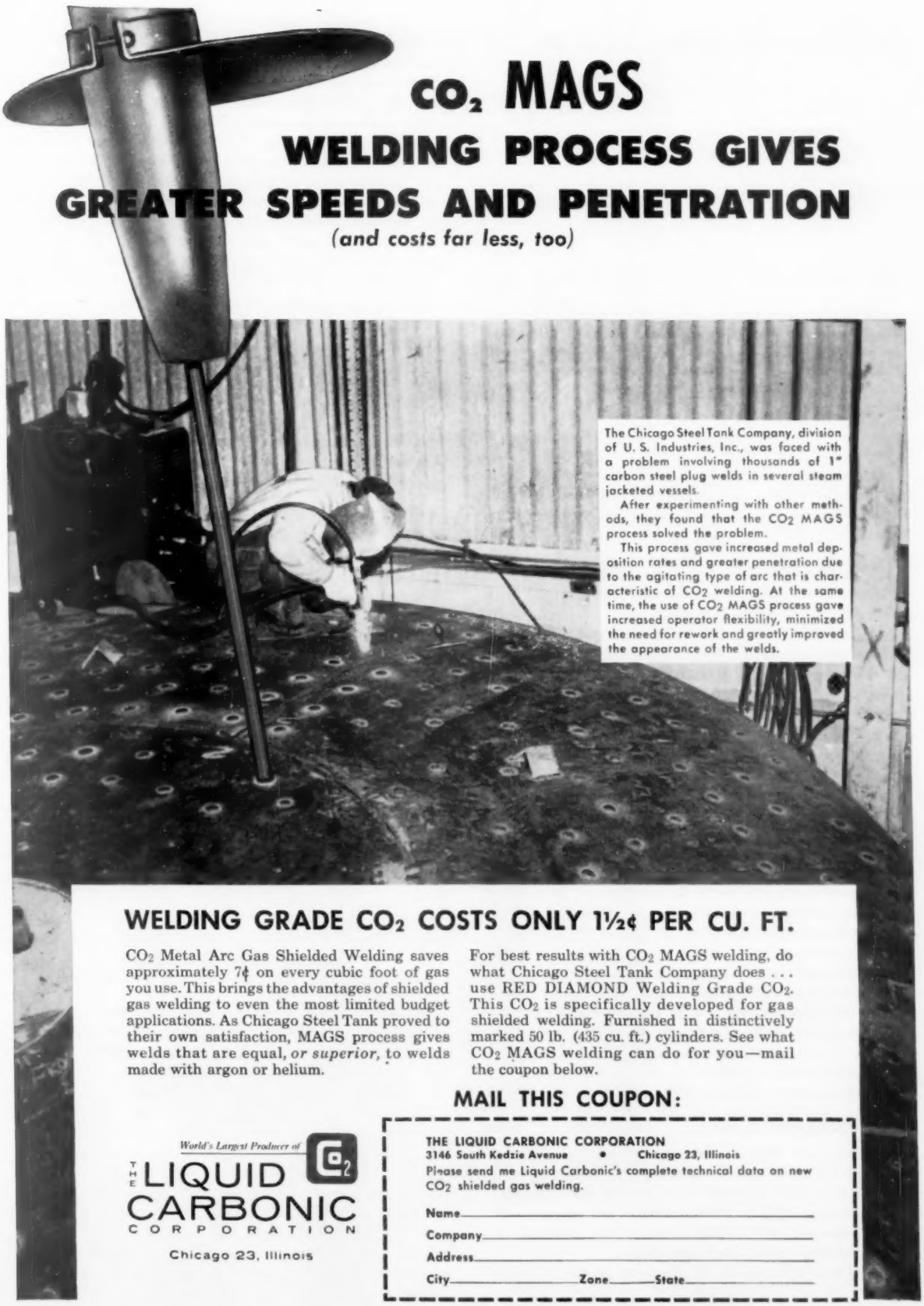
Typical Loading

The life testing program involved many relays and various load conditions. All testing was done with loads typical of those found in resistance welding circuits—so contact rating is based on load types rather than on current.

This type of rating is limited, but obviously gives the most accurate appraisal of relay capability. In order to collect data in the shortest possible time, test relays were operated at speeds exceeding those encountered in normal service.

These relays can be operated as fast as 1,800 times per minute; however, most test conditions were on the

CO_2 MAGS
WELDING PROCESS GIVES GREATER SPEEDS AND PENETRATION
(and costs far less, too)



The Chicago Steel Tank Company, division of U. S. Industries, Inc., was faced with a problem involving thousands of 1" carbon steel plug welds in several steam jacketed vessels.

After experimenting with other methods, they found that the CO_2 MAGS process solved the problem.

This process gave increased metal deposition rates and greater penetration due to the agitating type of arc that is characteristic of CO_2 welding. At the same time, the use of CO_2 MAGS process gave increased operator flexibility, minimized the need for rework and greatly improved the appearance of the welds.

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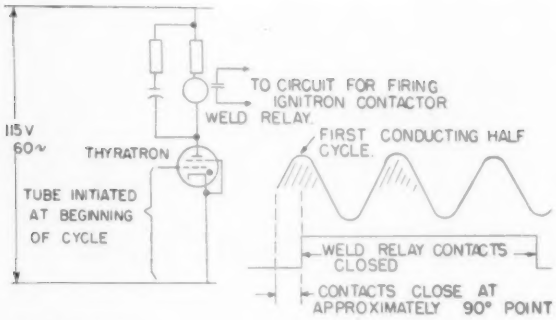
TO CIRCUIT FOR FIRING IGNITRON CONTACTOR
WELD RELAY
115 V 60~
THYRATRON
TUBE INITIATED AT BEGINNING OF CYCLE
FIRST CONDUCTING HALF CYCLE
WELD RELAY CONTACTS CLOSED
CONTACTS CLOSE AT APPROXIMATELY 90° POINT

TWO-POLE relay in circuit for firing an ignitron contactor controlling welder current. Relay is energized by small thyratron operating on a-c. If conduction of thyratron is initiated at beginning of a cycle, relay will close its contacts with good consistency near 90-deg point of this same half-cycle and fire the ignitron contactor. Relay thus provides an economical long-life method of precise firing.

order of 240 to 1,200 times per minute because of load limitations. All tests stopped short of relay failure so that a larger number of relays could be tested. After 30 to 50 million operations, many relays were stopped and inspected.

Life test Summary

Here is an up-to-date summary on life tests of the four-pole unit.

(1) No-load tests to determine mechanical life were made at various speeds up to 1,800 times per minute. All tests were ended at 100 to 125 million operations—*without failure* (tests several years ago indicated a mechanical life exceeding 200 million operations).

(2) One contact of each relay under test controlled three relays of the same type as the test relays. These load relays were operated on half-wave rectified current from a 115-volt power supply. Operating speeds up to 500 times per minute were used. Most relays were removed from test at about 40 million operations. No evidence of faulty operation was found during this period, and on those relays run longer, end of life from loss of contact material occurred above 60 million.

(3) One contact of each relay under test controlled one size 0 contactor operating on 115 volts, 60 cycles. An operating speed of 240 times per minute was used. Test results indicated this was the maximum inductive load for long-life operation. Failures of normally closed contacts occurred in the 10-20 million range, and of normally open contacts, in the 20-30 million range. By adding a simple arc-suppression arrangement (a capacitor in series with a resistor across the contactor coil) a life improvement of 20 to 30% was obtained.

Two-Pole Relay Results

(4) Test relay contacts were used in a timing circuit to control charging and discharging of capacitors. Peak currents of several hundred milliamperes were encountered. Speeds as high as 900 operations per minute were used. Contact failures in this series of tests occurred at from 70 to over 100 million operations.

Given below are results of life tests on the two-pole relay.

(1) Loading consisted of a direct-acting solenoid air valve rated at 140 volt-amp, 460 volts, 60 cycles, with an inrush current of 1.2 amp. An operating speed of 360 times per minute was used. The load was controlled through the two contacts, breaking both sides of the line. Tests were terminated in the 30 to 40 million range; contacts showed some deterioration at this point, but were still good for many more million operations.

(2) Operation of solenoid air valves on 115 volts a-c is seldom used, but a limited amount of testing was done to determine relay capability with this load. The air value was the same size as that used in the previous test. Series operation of contacts was used, and tests indicated an end of life in the 20 to 25 million range. With parallel contacts opening one side of the line, life would probably be extended to 30 million operations or more.

(3) The two contacts in series on the test relay were used to fire the ignitor of an ignitron contactor controlling a resistance welder with its electrodes closed. Speeds up to 1,200 times per minute were used, and tests on most relays were ended in the 30-40 million range without failure. Several relays operated beyond 60 million before end of life was reached.

Better Life Expected

Tests were not conducted with the two-pole relay controlling either the size 0 contactors or pilot-type solenoid air valves. However, since both of these devices impose a lighter load on the relay than the direct-acting valves, much better life can be expected.

Life tests have demonstrated that these relays are good for many millions of operations. A figure more important to the user would be the elapsed time in actual welding service which this represents.

For an example, let's take a gun-type welder operating 400 times a minute, 16 hours a day, 5 days a week. With the usual lost time for set-ups, material transfer, coffee breaks and other reasons, the speed would probably not exceed 15% of maximum when averaged over a period of a week.

Under these conditions, 20 million operations (a conservative figure for most relay applications) would represent a life of approximately a year and a half. Since this is a minimum condition, it is reasonable to expect a life well in excess of this figure. Furthermore, in many welding applications where speed is much lower, the relay could easily last for many years.

Over 30 Million

It can be concluded from these tests that a life expectancy in excess of 30 million operations can be expected for most relay applications in resistance welding circuits, and that this should represent at least two years of life under average service conditions.

One exception is the case of the four-pole relay used to control a size 0 contactor where end of life occurred in the 10 to 30 million range. Since these contactors are rarely used in high-speed welding service, relays controlling this load type can still be expected to give several years of life.

Where a greater number of relay operations are required, arc suppression or paralleling of contacts can be used—or the two-pole relay can be substituted if its contact arrangement is satisfactory.

The new automatic welding process everybody likes

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DUAL SHIELD*

The DUAL SHIELD process is something *new* in welding, something dramatically *new*, something dramatically *better!* It's the new welding process that takes the guesswork and mistakes out of welding by *automatic* control. The proper arc voltage is maintained automatically. The electrode is fed to the work automatically. The weld is automatically protected from contamination, both during deposition and during cooling.

Weldors praise the DUAL SHIELD process; they can do better work faster and with less effort and strain. Welding shops like DUAL SHIELD; it not only cuts costs and avoids waste, it often opens entirely new opportunities for welded construction. Buyers of DUAL SHIELD welded products like them because of the cleaner, neater welds. Read what users of the DUAL SHIELD process say. Try this process on your work. You too will be an enthusiast.

PLEASE TURN THE PAGE.....

NCG® DUAL SHIELD*

(the new automatic process everybody likes)

WELDING

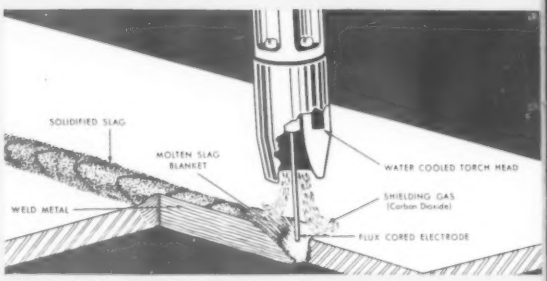
Science takes the guesswork out of welding with the NCG DUAL SHIELD process. Now, better welds are produced continuously because electrode feed and current density are set and held automatically . . . and because the weld is *completely* protected from atmospheric contamination, not only during deposition but during cooling as well.

In NCG DUAL SHIELD welding, inexpensive carbon dioxide gas is automatically fed to the arc to blanket and prevent contamination of the weld. The special flux-cored electrode is fed automatically and continuously from a reel. The flux is never in the way, never hides the weld. The DUAL SHIELD flux-cored electrode affords *absolute control of the amount of flux in the arc.* This is important in order to maintain accurate control of weld chemistry and assure a metallurgically uniform weld deposit. The slag "pops" off as the molten weld metal cools, and the weld can be easily cleaned with a wire brush.

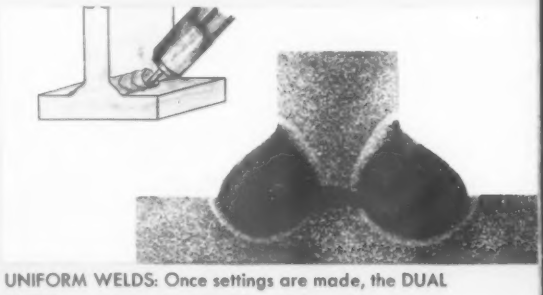
The DUAL SHIELD process is designed primarily for welding all plain carbon steels up to .35% carbon content and type T-1 and A202 steels. It can be used for single-pass welds in the horizontal and flat positions on thicknesses from 3/32" to 1/2". In addition, it is possible to make 1/4" fillet welds at more than 20 ipm and butt welds on 1/4" plate at more than 30 ipm . . . all continuously for foot after foot of exceptionally high quality weld. And, with the DUAL SHIELD process, no cleaning preparation is necessary for welding scaly, oily or rusty steel. The material is cleaned automatically as it is welded.

AUTOMATIC or AUTOMANUAL*

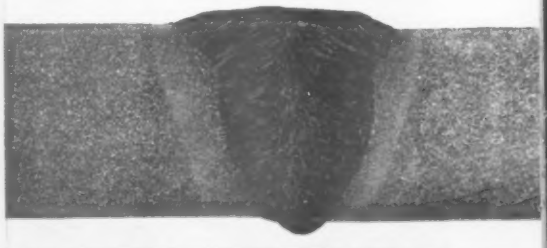
The DUAL SHIELD process is accomplished with the NCG Sureweld welding equipment. The basic Sureweld Type SA-1 outfit is for "Automanual" welding. It consists of electronic welding control, electrode drive, welding gun, and the gas and water cable assemblies. Conversion kits enable you to easily convert this to fully automatic welding. The DUAL SHIELD process makes fully automatic production welding most feasible. It is only necessary to traverse the gun or the work mechanically.



DOUBLE PROTECTION: Flux in the electrode core and a shield of CO_2 work hand-in-hand to produce sound, uniform and clean welds.



UNIFORM WELDS: Once settings are made, the DUAL SHIELD process makes smooth, uniform welds even on scaly, oily or rusty steel.



DEEP PENETRATION: A process feature is its ability to make one-pass welds in mild steel up to ½-in. thick.

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Welding Engineer brings you a report on welding behind the iron curtain and asks: are Russian welding engineers forging ahead in the race for better techniques? Sputnik adds impact to this query.

Reds receive awards for improving welding

By Rudolf Sobotka

MAIN BASIS OF mechanized welding in the Soviet Union is the so-called "UP" process. This automatic and semiautomatic procedure is said to reduce hand welding by 60% at the 800 locations where it is used. It is somewhat less effective—40% and below—when applied to boilers, ships, storage facilities, structural steel, large dimensioned pipes, and on chemical and oil installations.

Its chief drawback is that the machine's efficiency decreases as material thickness increases. This is because of the necessary edge preparation. To compensate for this, Russian engineers produced an "Electro-Slag" welding method.

A Lenin Prize

Developed by Y. O. Paton Institute in Ukrania, the productivity of this method is said to *increase* with growing thickness of material to be welded. Edges need no preparation and the automatic machine makes the weld in one pass.

Generally, the process is used on boiler sheets, medium carbon steels, and on low and high alloy steels. The citation accompanying a Lenin prize awarded the originators of the process states in part: "the method . . . can be used to weld metal of practically unlimited thickness and . . . obviates the need for complicated forging and casting."

Yet, despite its advances in other fields, Russian hardfacing is done almost exclusively by hand. Too, hardfacing is rare on wheel flanges, tractor parts, building machines, or on other machines and implements. Worn parts by the thousands of tons are thrown on the scrap heap.

Complete Radiography

Although D. A. Dulchevski, in 1920, successfully automated welding processes in Russian railway repair shops, automatic and mechanized welding is little used in those places. In 1955, for example, no more than 5% of the shops used automatic welding.

On the other hand, the Soviet Union claims all welded and cast machine parts are now examined by gamma rays for possible defects. More than 1,000 gamma detectoscopes are said to be in operation at industrial plants. And, according to Soviet sources, more than 100 welded bridges have been erected, reportedly saving 20% of steel used in conventional structures and cutting labor by 25%.

Another innovation is the MSG-500 welding machine. This is claimed to be superior in every respect to similar products of non-Russian manufacture for butt welding. The machine is said to be capable of welding 30 standard lengths of rod end to end in one hour. These lengths are then cut into required pieces.

The MSG-500's primary value is for welding steel rods used in concrete reinforcements. Machines of this kind have reportedly been installed at hydro-electric power sta-

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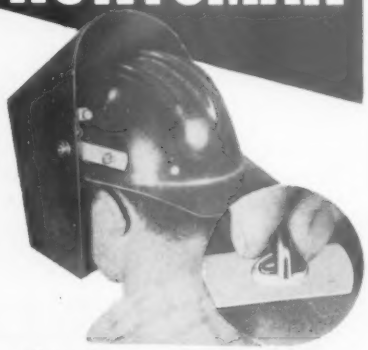

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tion building sites.

Near the beginning of this year, W. Will, Chief of Laboratory of the Scientific Union Research Institute for Electric Welding Machines, reported that his institute had been developing a method of welding by friction.

Friction Welding

He stated that experiments had proven friction would weld low and medium carbons and alloy steels to aluminum, brass, carbon steels, copper, and other metals and alloys.

The process was declared to be extremely simple. Of the two pieces to be joined, one rotates while the other remains fixed. Generated heat from rubbing surfaces causes the metals to fuse, thus producing the weld. The process is done on any type lathe and on some boring machines.

Automation is possible, Will said, because speed of rotation, the force pressing the rotating piece on the fixed piece, and the degree of compressive strain can all be controlled and changed.

Welding of this type, done on the Soviet DIP-300 lathe, will join rods with diameters up to 1.17 in. to 1.95 in. in diameter in a few seconds. Will added that tests have shown friction welding uses a fraction of the energy (8-15 voltamperage per 0.015 sq. in. of cross section.) that is required for electric arc welding of material of the same cross section. Static and other tests have amply demonstrated the durability and strength of the seams, Will said.

Soon on Production Level

According to the report, the institute is now developing the necessary equipment to introduce the process into building and transport industries.

Later in the year, J. Prudky, Director of the Research Institute for Welding machines and Welding Technology in Prague, reported in Czechoslovakian newspaper that immediately after the first news of friction experiments in Russia, the Institute began similar experiments.

Results of Prudky's work differed from Russian announcements. Prudky said satisfactory welds could be made at 1,500 rpm between round steel rods with diameters from 0.39 to 0.51 in., with a tensile strength of 6,500 psi, as well as between tubes of the same material with a diameter of approximately 0.59 to 0.39 in.

Tests with roundbar stock showed an average weld tensile strength of 92% of the steel. Bend tests were less satisfactory. Prudky declared, however, that once the process has been perfected this drawback will be overcome.

Welding time, according to the report, is about six seconds. But weld success hinges on the last moment of the process when fusion of the two pieces is complete, and when rotation of the lathe must be stopped instantly.

Prudky believed this process will be applied chiefly to welding of short, round pieces up to 0.78 in. Thus, thousands of drills formerly discarded at the Klement Gottwald Automobil works could be repaired easily and with little cost. Cost would be held down because energy used amounts to approximately 10% of that consumed to butt weld the same material—with a 0.59 dia.—by the resistance method.

Meeting Shows Advances

Meanwhile, engineers throughout Czechoslovakia were engaged in experiments on metal types which could be welded and what rotation speeds were best for the job. Later in the year, a meeting was held to sort out this information.

One engineer reported that wide use of friction welding was employed in repairing worn pump shafts. No longer, he said, did his company need to purchase new shafts; now, they cut off the worn part, and friction weld a new one to the piece. Manufacturing a new shaft cost $6.90 (pure labor), whereas repairing by friction welding cost only $1.40.

One report covered the solution to the problem of halting the rotation of the lathe as soon as fusion had taken place.

In order to spare the lathe mechanism, a separate 2,800 rpm motor was installed to transfer its rotation by a "V" belt directly to the lathe spindle head. A tailstock formerly holding the fixed part was replaced by a chucking device. When the weld has been made, a lever releases the chuck which rotates at the same speed as the part that had been clamped in the headstock.

* * *

For further information on Soviet welding techniques, read "Enough to make a Russ turn red!" *in* WELDING ENGINEER, *Oct., 1956, p. 54.*

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LEFT: Marvin Palmer, who has been with Smith since the firm was founded, makes 15 spot welds in just a few seconds on this steel arrow tip. Welder is a 7½-kva unit.

RIGHT: Tip has been welded, heat treated, painted, sharpened and mounted on arrow shaft. About 200,000 tips of all types were welded by Smith during 1956.

Here's a good tip: it's spot welded!

By Jack Fairlie

ONE MEASURE of the degree to which welding is being accepted as a reliable, economical, high-speed fabrication tool is the way in which welding equipment pops up in the most unlikely spots.

For instance, the casual passerby glancing into the windows of a shop at 731 Gratiot St. in Saginaw, Mich., might pause to appraise the archery equipment he sees there. He would probably note that this is Smith Archery Co. and that it offers a varied display of bows, arrows, and other paraphernalia.

These sights having registered in his mind's eye, our passerby would probably move on—never realizing that an important welding operation was being carried out in this shop.

200,000 in 1956

This welding operation, a spot welding job on steel tips for hunting arrows, is a bread-and-butter business for shop owner Ed Smith. In 1956, he and his assistants welded approximately 200,000 tips. Some were mounted on shafts for sale in his own store, but the bulk of the tips were sold to other retailers.

Ed Smith started fabricating arrow tips in 1947 as a part-time enterprise. His full-time job was that of a Saginaw policeman. However, as the sport of hunting deer and bear with bow and arrow grew in popularity, Smith's "pastime" become a chore without let-up.

In 1952, it became apparent to Smith—who is himself an avid bowman—that his particular road to success had arrived at a fork. To this day, he has no regrets concerning his choice.

Brazing Eliminated

Spot welding was not the first joining process used by Smith on the tips, which have always been formed from two stamped pieces of 0.020 in. thick tempered steel. In the beginning, furnace brazing with a copper alloy was attempted.

Although the copper-brazed joint had proper ductility and good tensile strength, it created two serious drawbacks. The brazing operation carburized the steel parts, and the brazed area in the joint interface was too soft to take and hold a sharp edge.

Investigating his joining problem, Smith found that resistance spot welding would give him a joint strong enough to withstand the severe jolts an arrow tip must take, and greater fabrication speed as well. Tips sent out to be spot welded performed satisfactorily, so Smith ordered a foot-operated 15-kva unit for his own use.

This machine, which actually provided more power than was needed for the job on hand, sealed its doom by operating cantankerously at critical moments. Spot welder No. 2 soon took its place.

Rebuilt 3 times

This little 7½-kva machine, which makes better welds because of its hydraulic controls, has been rebuilt three times. Only the air cylinder is original equipment.

Arrow tips, each of which requires approximately 15 spot welds, can be processed through the welding machine at a rate of 7,000 a week during periods of continuous production. Steel for the tips is purchased in 2½-in.-wide, 100-lb coils, and stamping is done in Smith's shop.

Smith has contracted with another firm for heat treatment of all tips welded in his shop. Specifications on this heating job call for a finished tip hardness of 45 to 48 Rockwell C. Tips are spot checked for soundness before heat treatment by driving a tapered pin into the open end which receives the shaft.

OWNER Ed Smith places tips on holders of painting device he invented. Moving belt spins holders and trips lever on paint spray gun. Tips have just come from heat treating operation.

An economical copper-alloy electrode is Smith's current choice for his welding work. Approximately 5,000 arrow tips can be welded per set of electrodes before the tapered die face becomes too worn.

Startling Growth

As a point in favor of his seemingly limited operations, Ed Smith cites startling statistics gleaned from Conservation Dept. records.

"When I first hunted deer with a bow and arrow in 1939," he recalls, 'there were less than 400 licensed bowmen in all of Michigan. By 1956, that number had grown to approximately 45,000."

Bow and arrow hunters — whom riflemen once pitied—are now doing themselves proud with kills ranging to trophy size in many parts of the country where the sport has caught on. And these stalkers (the bowman must get as close to his quarry as possible) have gained an edge over their gun-toting fellow hunters in most states, because the bow-and-arrow hunting season begins well ahead of that for riflemen.

Questioned about the durability of the arrows he tips, paints and feathers for sale in his and other shops, Ed Smith notes that "the shaft of a hunting arrow that's found its mark will probably be damaged beyond further use.

"But these tips. Well . . . they're welded; they can take it."

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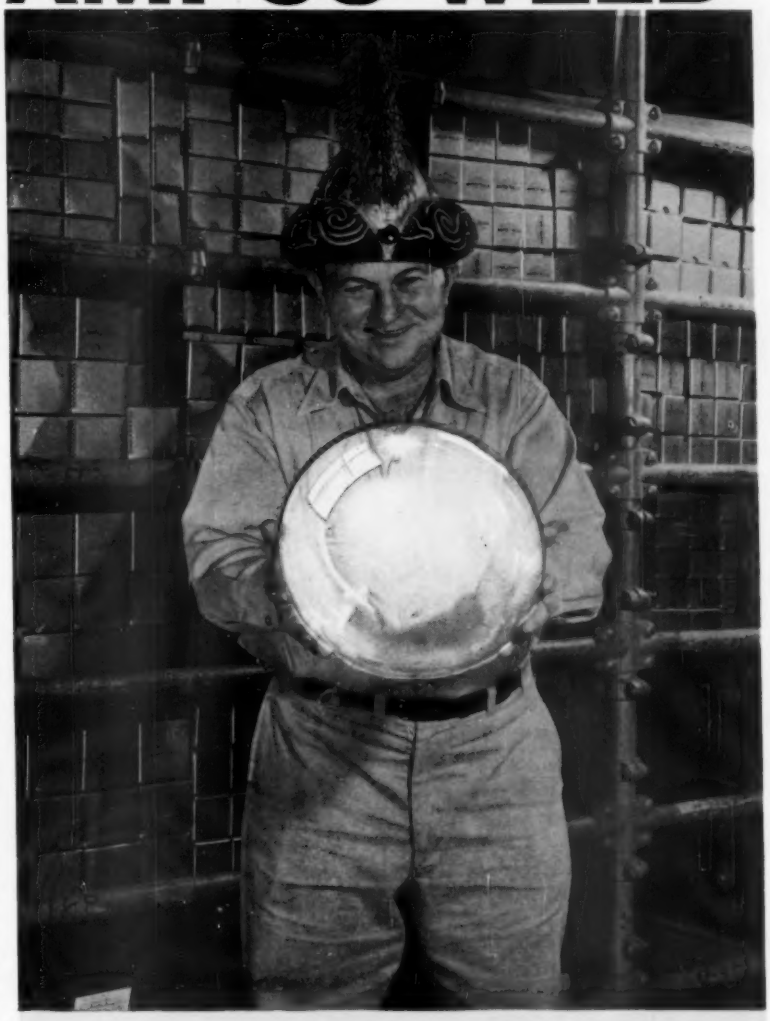

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ABOVE: Inspector tests welds for leaks. Plates are vacuum drawn and filled with ammonia. If welds around plugs are not air-tight, ammonia flowing through the flaws will turn white as the worker's sulphur-tipped taper touches it.

Take a visit with WELDING ENGINEER to a plant that knows how to make production rates soar and keep workers happy

Welding—hot stuff on cold work

By F. W. Foerste

LOOKING like a man from outer space, a metallizer zinc-sprays vacuum plates.

IS YOUR COMPANY seeking high production, few rejects, and contented, long-term weldors? If it is, join WELDING ENGINEER on a visit to Dole Refrigerating Co. where all this is a fact, not a dream.

This Chicago firm manufactures cooling units. These range from frozen food processing tables to huge racks for boosting outputs from institutional air-conditioning machines. Welding operations—from gas welding to Tig welding on stainless steel—enable the company to turn out sturdy, effective products with a reject rate well below one percent.

The firm's major product is a refrigerating plate used in trucks. This plate is filled with a eutectic solution (a composition which freezes at constant temperatures). Purpose of the eutectic is to provide a "holdover" effect on the vacuum-drawn plate.

Trucks hauling milk, meat, produce, ice cream, and frozen foods use these plates extensively. During the night, trucks are connected to a mechanical refrigeration system in their garages, and the eutectic is frozen. In the morning, trucks are unhitched to continue their runs with melting solution acting as a coolant to preserve the food.

But holdover cannot be gained without a vacuum within the plates. This is the reason Dole uses welding in its manufacturing program. The idea of rivets or bolts to join plate sections is shrugged away.

"Sure, we use welding," the firm's production men say. "There's nothing else we can use. After all, we've got to have a vacuum, and you can't have one with rivets."

To make plates, however, a number of steps in addition to welding are necessary. The first step is forming coils to fit inside the plates. This is done by bending $\frac{3}{4}$ in. diameter tubing into a serpentine form. About ten turns on a hydraulic machine will shape a tube into the required number of coils.

Coil Testing

Because coils must be airtight, they are rigorously tested. Air under high pressure—300 psi—is forced through the coils while they are held under water. Leaks are revealed as air flows out of them and bubbles in the water.

Meanwhile, plates designed to contain the coils have been formed. And, after coils have been placed in them, go on to be spot welded. This serves to hold them together during other welding operations. Two men work the 50 kva portable spot welder which delivers 30 volts

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SPOT welding plates to hold them during later work. Machine is a 60-kva portable spot welder giving 30 volts on 60 cycles.

on 60 cycles, using ½ in. diameter copper alloy electrodes. One man loads the welder; the other handles the gun.

From the spot welding operations, plates move to a seam welding station. Again there are two workers: one to set up the work and the other to man the equipment. Joints have already been ground to insure surface cleanliness, and the operators have only to make the seam weld.

Welds are made with a 40,000 amp, 200 kva, 60 cycle a-c machine. This operates on a two cycles on/one cycle off ratio as plates move forward under 1,000 lb pressure. Two 10-in.-diameter wheels formed of copper alloy do the sealing job.

With a metallic skin binding the plate's skeleton, it moves on for yet another weld—this time by the oxyacetylene process. Several weldors are employed to work the torch in sealing corners and installing six plugs. Units cannot be brazed or soldered because ammonia, used in the next step, and often as a refrigerant, would corrode the brass. Welding rods vary from 3/32 to ⅛ in. and acetylene pressure is 10 psi.

WORKER feeds plates between circular electrodes of a resistance seam welder. Joints have already been ground.

Fabrication of both plate and coil is now complete. But one more test is yet to be run. It will probe for any leaks around the plugs. Company engineers have devised an ingenious technique for this.

First, all plugs are sealed and a vacuum is created. Ammonia is now pressured into one of the ducts under 25-30 psi. If there are any leaks, a strong ammonia odor can be immediately detected.

But odor is not enough. Granting the tester knows there is an opening, he still must locate it.

For this purpose, the inspector carries a sulphur-tipped taper which he moves about the plugs. Escaping ammonia touched by the taper turns white around any openings. Now having a colored target to guide him, the inspector can pinpoint a flaw and correct it by re-welding.

Surface Preparation

The surface of the plate's 16 gage mild steel is prepared by blasting it with metal grit. Metal particles are fed through a hose under air pressure of 125 psi. As the grits strike the surface of the plates, they clean off any rust or dirt and pit the surface to give a soft-gray, attractive appearance.

The plates, having been cleaned and prepared, move on to be metallized. This is done by spraying zinc on them. The zinc spray, designed to protect against corrosion, is as effective as galvanization, company engineers say—even though galvanization would not be practical because of the pressures set up by the vacuum.

Swathed in a heavy apron and helmet, the zinc metallizing operator appears to be a recent arrival from outer space. His method, however, is very much of this world.

A ⅛ in. zinc wire feeds into a flame supplied by oxyacetylene pushed through the hoses under greater pressure than is normally used for welding. As soon as the zinc strikes the flame, gas force causes it to spatter; thus giving a finish which holds very well because of the pitted surface formed during blasting.

Vacuum Packed

One more operation is needed to round out fabrication. In this final phase, sealing plugs are loosened and the vacuum allowed to escape. A eutectic solution fills the plates. A vacuum is again formed to solidly anchor coils to the plate so there is no motion inside the plate.

After temperatures for which the plates were designed are stenciled on them, the units are ready for shipment and installation.

As for shop morale. . . When WELDING ENGINEER's reporter walked away from the metallizer and his nerve-wracking, eardrum-bursting job, he commented that the labor turnover for that work must be very high. "Well, I don't know," a company official replied, "you see, this man's been on the same job for 20 years."

The official added that all weldors in the plant have been employed for over ten years as an average. This record is probably due partly to the fact that weldors at Dole are paid approximately 23% more than weldors elsewhere and partly due to an incentive plan based on piece work.

Does welding help in high production work? Dole Refrigerating Co. has a ready answer for that question. The answer is "Yes."

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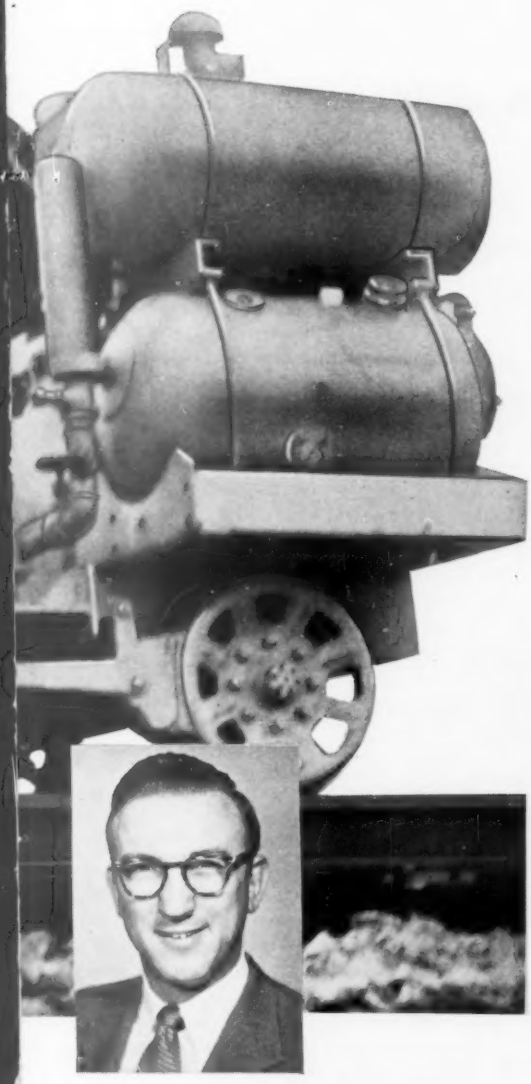

The man from A. O. Smith

Byron Motl is the A. O. Smith welding consultant who worked with Railway Maintenance Corporation. More than a salesman, he's a trained welding specialist . . . ready and eager to help with production problems.

First, you nip the railway tie up firmly against the rails. Then you drive four spikes—one on either side of both rails. All at a rate of better than 4 or more ties per minute. It's quick and *easy* — with Railway Maintenance Corporation's SpikeMaster.

EASY . . . because these fast-working units are built to deliver sure spike-driving power without faltering in tough mainline service.

Like all RMC railroad maintenance equipment SpikeMaster features welds made with A. O. Smith SW-44 electrodes on heavy-gauge steel components.

An iron powder electrode (AWS class E-6024), the SW-44 excels in high-speed operation . . . deposits far more tough weld-metal than conventional rods. Actually, many users report the SW-44 cuts welding time 25% . . . electrode cost by as much as 10%. Speed and strength are far from all. You get smooth, self-cleaning welds . . . the quality look that sells your product.

Want more facts about the SW-44 and other top-performing electrodes? Call "Your man from A. O. Smith" . . . or write direct.

Through research A.O. Smith *. . . a better way*

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

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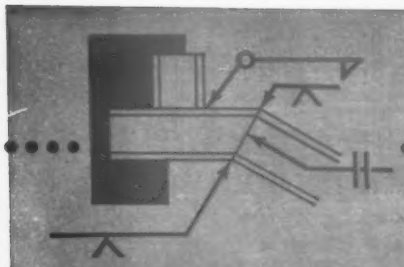

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Propane, crankshaft and molybdenum problems

Question:

On the Philippine Islands we are unable to obtain propane gas for oxy-propane cutting. We do, however, have a liquefied petroleum gas composed by volume of the following: 2.0% propane, 78.0% iso-butane, 19.5% butane and 0.5% iso-pentane. Pressure of the gas, which we have termed butane, varies from 60-70 psig, and average temperature is around 85-95 F. How will this affect oxy-LPG cutting?

Answer:

Because the gas you describe so closely resembles butane, and because of its high Btu content, it should make an excellent cutting gas.

Any figures you might have concerning oxy-LPG cutting performance would apply to your mixture. In fact, if differences were detected in results, your mixture would probably offer better performance characteristics than oxy-LPG.

As for variations caused by pressure and temperature—disregard them. Your mixture will do a good job; with a highly skilled weldor handling the torch, it might even be better than the average expected from oxy-LPG cutting.

The human factor has a way of overcoming apparent disadvantages.

Question:

We are having difficulties with our electrodes when working on 4150 molybdenum steel. Perhaps a different electrode selection would help us.

We use a low-hydrogen type in welding the steel to a tractor frame to strengthen it. Weld metal fused to the frame, but not to the molybdenum.

Answer:

A 4150 molybdenum steel is difficult to weld because of its high carbon content. Your difficulties lie, as you have noted, with the electrodes used on this job. But the problem can be solved.

You state you are not getting fusion. More likely, however, you mean that the welds are not holding and are pulling loose from the molybdenum steel bar. This occurs because of the extremely brittle conditions resulting from trying to weld 0.50 carbon steel.

Difficult Preheat

One way to overcome your problem is to preheat the bar. This may be rather difficult, for the bar must be preheated to a red heat and allowed to cool slowly after welding.

A second solution would be to use 2512 type stainless steel to make the welds. Ductility of the electrode is such that, on cooling, welds will tend to stretch, and will not pull away from the molybdenum bar. Thus, the high-carbon cracking situation you now have would be prevented.

Another method entails the use of a new E-Fe-Mn-A electrode, giving good wear and impact qualities. It was created especially for welding higher carbons and difficult-to-weld steels like manganese, etc. Your local distributor probably can supply you with it.

Either 2512 electrodes (E 309-15 or 16) or this new electrode will do a good job on the molybdenum. Carbon content in 4150 molybdenum is far too high for a low-hydrogen electrode to work effectively.

The Editors will make every effort to answer all questions submitted to this department. If you have a question concerning welding or related processes—or a tip you would want to pass along to other readers—send it to *The Welding Clinic.*

Question:

We have a 200-amp d-c welder and wonder whether we can use it to build up undersize throws on automotive and diesel crankshafts? The shafts must be straightened after welding.

Answer:

Unfortunately, it is impossible to build up crankshafts in this manner.

You have the right process for crankshaft repair—but not buildup.

The usual method of building up crankshafts is to deposit a few thousandths of an inch of metal to replace material worn away. Metallizing is the only process which can economically be used to lay down such a fine layer.

A crankshaft *can* be built up by welding, but there is an excess of metal which must be ground away. This is not only expensive, but often results in unequal metal hardness on surfaces, and perhaps a heat-distorted crankshaft. Because of this, a shaft rebuilt in this way would probably cost more than a new one.

Therefore, we would not recommend the job you are planning. (For more information on crankshaft welding, read the article in this issue.)

Sigma Welding
gets truck trailers on the road fast

High-speed production of aluminum truck trailers calls for fast and efficient methods of welding. LINDE's Sigma Equipment and LINDE Argon keep trailer production lines rolling.

LINDE Apparatus for Sigma welding makes top-quality joints in all commercial metals. Production speeds up to 100 inches per minute are easily obtained, with clean, smooth welds. LINDE Argon, guaranteed 99.99% pure, is used to shield the arc. It's readily available in cylinders or in bulk, from convenient sources all over the nation.

Find out how LINDE Sigma Apparatus and LINDE Argon can help improve your product and increase your production. For a free copy of the booklet, "Modern Methods of Joining Metals," address Dept. WE-11. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

FOR THE BEST IN ELECTRIC WELDING—LOOK TO LINDE!

Sigma welding, with LINDE Apparatus and LINDE Argon, makes possible high-speed production welding of aluminum and other commercial metals, manually or automatically.

Linde TRADE-MARK

UNION CARBIDE

The terms "Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Pipe welding (shown here) is one of many jobs handled by the "Pipeliner."

NEW all-purpose torch welds, cuts, heats, brazes and solders

Now, get clean, high-speed cuts *plus* minimum gas consumption with SMITH'S new, lightweight "Pipeliner" torch. This handy "Pipeliner" cuts up to 4" steel; has 7/8" welding capacity—*yet weighs less than 2 lbs.* Special tips adapt the "Pipeliner" to heavy scarfing, rivet washing and gouging. Exclusive slip-in cutting tips seat perfectly with fingertip pressure—have recessed, damage-proof seats. Users say this feature saves up to 50% of tip replacement costs.

Exclusive Flo-Trol guards against backfires

ELIMINATES SEAT BURN OUT. One of the many top-quality features of SMITH'S "Pipeliner" is the exclusive "Flo-Trol" mechanism. This spring-loaded diaphragm prevents the reverse flow of acetylene to the cutting valve and seat. Eliminates danger of pre-mixing and pre-ignition of gases . . . protects torch against backfire and burned out seats . . . reduces downtime.

Other features: Silverbrazed, leak-proof joints (entire torch body is one leak-proof unit). "Floating ball" type needle valves shut off gas tight with slight finger tip pressure. "O" type seal rings keep gases in the proper channels until they reach point of mixing. Cutting jet lever gives easy, convenient control of the cutting oxygen stream.

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A welded "lift" for an old bridge

NEARING the century mark in age is this historic suspension bridge at Wheeling, W. Va., connecting that city to the Ohio side of the Ohio River.

Built in 1860, and reportedly the oldest existing bridge of its type in the country, the structure was once a toll bridge and also carried rails for electric cars in its narrow wood flooring. These have long since been uprooted in one of countless repair and maintenance projects on both flooring and the steel work.

Latest facelifting job involved the installation of arc welded open-deck flooring and walkways, plus all-new transverse floor beams. The latter are 24-in., 76-lb WF beams placed on 8-ft centers and held in place by a combination of welding and bolting.

Main flooring is a 5-in. I-beam weld-lock grating welded to top flanges of floor beams. Walkways are 1¼-in. welded grating panels arc welded to longitudinal channels which, in turn, are arc welded to angle brackets resting on the transverse beams. These raise the walkway level about 10 in. above the roadway.

No filler material is used in either road- or walkways in the interest of good drainage and non-skid surfaces. Welding generators and electrodes for the job were furnished by Lincoln Electric Co. and the contractor was Ferguson & Edmundson Co. of Pittsburgh.

WELDING and SAFETY EQUIPMENT

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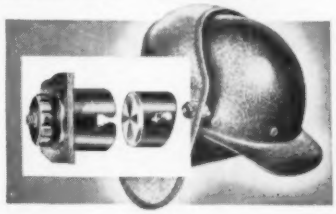
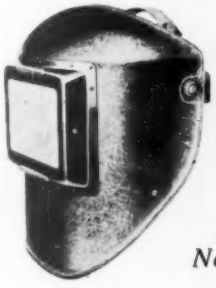
QUICK-LOK © **for Cap & Helmet Combination**

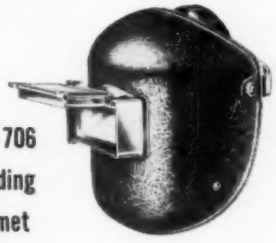


Bulletin No. 49



No. 608 Wide Vision Welding Helmet

Form No. 51-R



No. 706 Welding Helmet

Bulletin No. 39

No. 600 Welding Helmet

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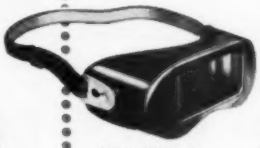
ALUMINUM Safety Hats

Bulletin No. 55

Solo goggle ©



SOLO GOGGLE No. 55

HEADREST F-550

Bulletin No. 53

SuperGlas ©

Safety Hats & Caps

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because they LEAD IN QUALITY!

The name FIBRE-METAL stands for highest quality . . . quality preeminent in the field of welding and safety . . . based on broadest experience and continuing research to produce the kind of equipment that gives maximum protection to the welder . . . along with the comfort and "work ability" that enable him to produce more work per day. *Ask for Bulletins . . . or order by number.*

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Bulletin No. 41

THE FIBRE-METAL PRODUCTS COMPANY CHESTER, PENNSYLVANIA

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In London's Olympia:

British exhibit atomic age welding trends

By Peter C. Hobart
Hobart Brothers Co.

THE NUCLEAR ERA is officially recognized in the second half-century of English engineering exhibitions.

Extending from August 29 to September 12, England's (and perhaps the world's) largest engineering exhibit occupied the whole of Olympia, London's largest exhibition hall. The biannual display, in which nearly 500 manufacturers were represented, was termed the British Engineering, Marine, Welding and Nuclear Energy Exhibition.

This year, in an attempt to recognize developments of today with relevance to the future, nuclear energy was included for the first time. This consequently became the main theme of the show, and England's numerous atomic power stations served as keynotes: both their operation and their fabrication emphasize welding.

BOOTH sponsored by Rockweld, Ltd., exhibited firm's new line of automatic welding equipment using "Autopak," a new multi-purpose transformer welder.

DESIGNED specifically for shipbuilding industry by Quasi-Arc, Ltd., is a twin fillet-welding gantry, 40-ft section of which was on display at the Olympia.

CO_2 Is Instrumental

Calder, Berkeley, Dounreay and several other stations still under construction have been primarily responsible for many recent developments in arc welding with new alloy steels, extra-thick plate sections, and cast areas which once could be welded only automatically.

Carbon dioxide, used with a continuous coated electrode, has become the instrumental shielding gas for automatic applications.

British welding seems to be passing through growing pains identical to those of American industry. There is the impact of automation, electronics, and countless automatic welding processes.

There is also a newly-revived fad for iron-powder electrodes; an attempt to utilize cheaper gases (such as CO_2) for arc shielding; further refinements of transformers and rectifiers, and an endless procession of new electrodes to meet new demands.

On the Floor

At Britain's "big show" for 1957, automatic welding was the main attraction in most booths. Three firms—Murex, Rockweld, and Welding Supplies, Ltd.—entered the field already dominated by Lincoln Electric Co., Ltd.; Quasi-Arc, Ltd.; and Metropolitan-Vickers Electrical Co.

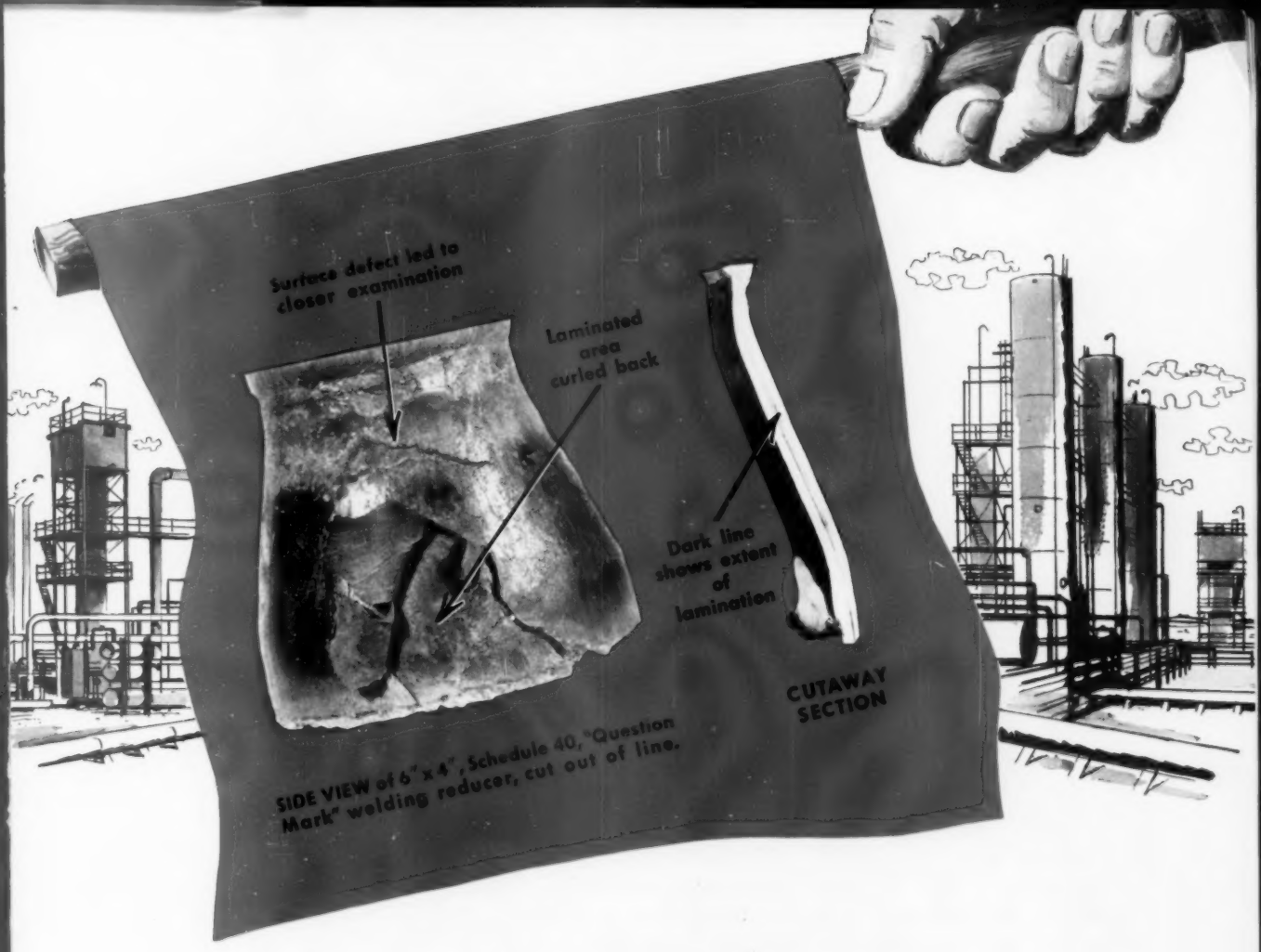
Lincoln (no longer associated with the U. S. firm of the same name) is the pioneer in the field of automatic welding equipment and has about 10 years' experience. But its familiar "Lincolnweld" unit has simply been improved for circumferential and longitudinal application. Metropolitan-Vickers equipment also seemed to show little in the way of research or development over the last few years.

Quasi-Arc, Ltd., on the other hand, with its standard "Unionmelt" and "Fusemelt" processes, has already surged ahead in finding numerous new applications for its automatic procedures. Most interesting Q-A unit on display was a 40-ft section of a twin fillet-welding gantry for the shipbuilding industry. Two automatic submerged-arc welding heads are utilized—one operating on a-c and the other on d-c to eliminate magnetic interference.

Awkward but Promising

Further automation was demonstrated by Quasi-Arc in a unit for internal seam welding of pipe up to 28 ft in length. A television camera mounted on the welding boom provides the operator with a constant view of the joining operation. A third Q-A development, the "Fusarc Mark III" self-propelled automatic welder, utilizes a continuous coated electrode shielded by CO_2.

The three new entrants into the automatic welding field


Surface defect led to closer examination
Laminated area curled back
Dark line shows extent of lamination
CUTAWAY SECTION
SIDE VIEW of 6" x 4", Schedule 40, "Question Mark" welding reducer, cut out of line.

Watch out for the after-costs of Question Mark fittings!

Unknown fittings may look like a bargain on the price tag, but watch out for the consequences!

Surface defects led to the above "Question Mark" fitting being cut from the piping. Further examination showed the steel inside was laminated. Pieces cut out literally fell apart. Here was an open invitation to serious trouble . . . lost production, wasted dollars and possible human casualties.

This is another example of a dangerous situation posed by unknown fittings of questionable quality . . . a serious threat to the safety and economy of well-engineered piping.

You can avoid these risks by specifying KNOWN fittings!

DANGER! *Your first warning of Question Mark fittings is their lack of complete, permanent identification of manufacturer, wall thickness, weight, material . . . as required by A.S.A. code.*

A message in the interests of top quality piping
. . . by Tube Turns, Louisville, Kentucky

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Safeguard your piping investment with known fittings!

TOP QUALITY! *Directional and size changes in this process piping are made with* TUBE-TURN *Welding Elbows and Reducers . . . recognized for their unsurpassed uniformity and quality.*

The cost of fittings is a small fraction of the total cost of a piping system. To buy "cheap" fittings and run the risk of impairing the performance of your entire system can, therefore, be "penny wise and pound foolish."

When you specify and buy TUBE-TURN* products, you know your investment is safeguarded by unsurpassed quality of fittings and flanges. They meet all American Standard and Safety Code requirements. Each product is permanently marked with complete size and material designation.

COMPLETE LINE! *Your nearby Tube Turns' Distributor gives you prompt delivery from the complete line of more than 12,000 Tube Turns' stocked items. Photo courtesy The Ross-Willoughby Co., Columbus, Ohio.*

STANDARD for Butt-Welded Carbon Steel Piping Systems. Covers materials, assembly methods and welding procedures to use for safe, economical and maintenance-free piping. Mail the coupon for your free copy.

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are apparently reacting to market demand. Their developments, though awkward, hold great promise.

Murex, one of England's welding giants, has introduced "Muramatic," a versatile a-c/d-c process for standard submerged-arc welding or an open metal-arc process using a continuous coated electrode manufactured by Murex.

Rockweld, Ltd., has an entirely new automatic welding line which uses the firm's new multi-purpose transformer welder, the "Autopak." This unit has the advantage of being a power source either for automatic welding or for single or double-operator manual a-c welding. Rockweld's "Autopoint" welding head is designed both for submerged-arc and CO_2 applications.

The third member of this group—Welding Supplies, Ltd.—has introduced the "A.4" automatic welding machine for both submerged-arc and continuous coated electrode welding applications.

Electrodes reflect the nuclear age through rapid development of several new high-impact, high-temperature types for welding nuclear fission vessels. Iron-powder, too, has played an important role in the development of new electrodes.

But, in the overall view, the greatest British improvement in standard electrode application seems to be the "Fastex 100," designed by Murex for rapid vertical downward pipe welding with decreased undercutting and easy slag removal.

Positioner Developments

In view of the rapid mechanization of the British welding industry, it was not surprising that many booths exhibited new types of positioning equipment.

The largest manipulator on display was the 225-ton roller developed by Donald Ross & Partners, Ltd., for the automatic welding of heat exchanger sections destined for the atomic power station at Bradwell.

The most comprehensive display was provided by Courtburn Positioners, Ltd., whose specialty is custom positioning. Of special interest was the demonstration of completely automatic welding of 20-ton cylindrical vessels by means of a column and boom, rotators, and an operator platform.

F. Bode & Son, Ltd., and Yates Plant, Ltd., were the other important exhibitors, but their products were not unlike American counterparts.

Resistance Welding Trends

The larger manufacturers of resistance welders—Metropolitan-Vickers Electrical Co., Crompton Parkinson, Ltd. and Sciaky Electric Welding Machines, Ltd.—had impressive displays. But their research did not seem quite as advanced as that of some smaller concerns.

Hoden & Hunt, Ltd., for instance, have produced a new 15-kva spot welder with automatic features for single and continuous spot welding sequences. Bates & Bates, Ltd., featured an 8-spot "rack" welder which automatically welds up to 8 spots in any desired pattern or configuration.

Hirst Electronic, Ltd., produced a resistance welder with completely automatic indexing for assembling small components. Fuller Electric, Ltd., displayed two impressive machines—an air-operated, 150-kva projection welder with electronic and protective devices for a maximum section of 0.38 sq in., and an automatic flash welder for joining pipes from 0.168 to 5.25 in. in diameter.

A. R. O. Machinery Co., Ltd., had one of the most interesting displays, featuring new spot welding guns. Since the development of its new "DP.45 Twinspot" guns, ARO has been able to devise numerous applications and positioners.

Gas Improvements

The emphasis on gas cutting and welding developments on exhibit was noticeably placed on argon, carbon dioxide, nitrogen and hydrogen. British Oxygen Gases, Ltd., seemed to be pioneers in new products with such items as the "Argonarc" process for precision welding reactor vessels; "Argonaut" equipment for high-quality automatic welding, and a new nitrogen or nitrogen-hydrogen shielded tungsten arc for cutting aluminum.

"OVERLANDER" is the name given to this diesel-driven mobile welder—one of many new products on display in the Murex booth.

Saturn Industrial Gases, Ltd., showed further developments in its "Surge-Injector" argon arc welding units ("Mark II and III"), which are designed for rapid welding of aluminum and its alloys, and stainless steel.

Hancock & Co., Ltd., devoted its exhibit to new precision methods of oxygen-cutting non-radial holes to close tolerances in the steel domes of reactor pressure vessels. Critical factors in such a job are the hole size, special double-beveling involved, and a nose preparation for welding which involves new engineering methods.

British Industrial Gases concentrated on CO_2 and its application to welding with a display of several new regulators and control equipment. Eutectic Welding Alloys Co., Ltd., introduced a line of flux-coated rods for gas welding which are unaffected by humidity.

The Two Leaders

It is interesting to note that, concurrent with the demand for precision welding, the Olympia exhibition indicated a new interest in non-destructive weld inspection methods—both radiographic and ultrasonic.

British industry, as usual, is in the vanguard of new developments in the engineering world. It is making great strides toward the nuclear age.

With America, it leads in the world in scientific progress. And, *sputnik* to the contrary, a free exchange of new ideas should help the two nations to remain leaders of the free world.

—Nelson Stud Welding Div. photo

STUD welding gun under operating conditions. Speed of the gun—a stud is welded in less than a second—and its portability—one man easily operates it, is causing a great increase in its popularity.

Weldors ask: "where do the studs go on this job?" Here's help for the problem.

Jigs and fixtures locate studs accurately

By Clement F. Brown

THE WORKMAN bends over a steel beam, presses a gun-like tool against the metal, watches a momentary flare of molten metal between the gun tip and the beam, then moves on. Behind him, welded at one end to the beam, is a threaded metal rod looking just like the bolt it has replaced.

This is stud welding, one of the newer members of the arc welding family. A free-wheeling process—which usually does its job in less than a second—it utilizes direct current to actuate its gun-type mechanism.

When the operator places the stud-loaded gun against a metal form and presses the trigger, electrical current flows through the stud. As the current moves, the flux-filled end of the stud is automatically retracted from the work piece to create an arc. Fusion temperature is quickly reached and the stud is driven against the work-piece.

Solidly in place, the welded stud not only possesses a strength equal or superior to that of a similar size bolt, but it eliminates the metal-weakening holes inherent with the use of bolts.

Operation Facts

Before welding takes place, a stud must be inserted into the gun where it is held firmly in place by a chuck. A ceramic or porcelain ferrule, positioned in a copper grip at the tip of the barrel, covers the fluxed end of the studs.

This ferrule shields the welding arc, preventing oxidation of weld metal and stops the molten metal from escaping at the moment of impact. Extending below the copper grip, the ferrule's body also helps position the stud with the aid of a template or fixture.

Fixture design is governed by required accuracy of stud locations. Accuracy can be achieved by guide hole size, its spacing, or by position of the fixture. Straightness of the stud is determined by fixture thickness; in most cases, however, perpendicularity is not critical.

Another method of positioning studs is through use of an elevated fixture. Spacer bars hold the fixture 1/16 in. above the workpiece to allom gases to escape during welding. A guide bushing may be attached to any fixture type to further facilitate positioning of the stud welding gun.

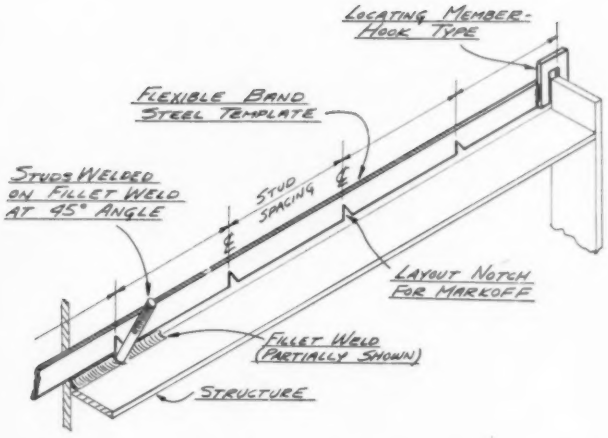
Manual Positioning

There are three courses open for stud placement when fixtures are not used. One permits the operator to estimate exact stud placement. This, however, is the least desirable method since it is suitable only for the roughest type of work, and because welding speed is slowed while the weldor makes decisions.

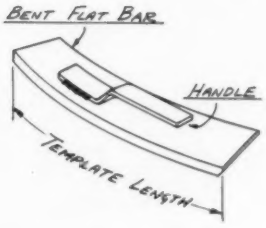
On some operations, welding is done just before final assembly. This avoids delays due to placement of templates or fixtures, but it lacks the accuracy of fixtured work, and entails the inevitable expense of an out-of-sequence operation.

A third approach calls for laying out the work and marking stud position with a center-punch. Use of a center-punch is acceptable, but layout is time-consuming and expensive.

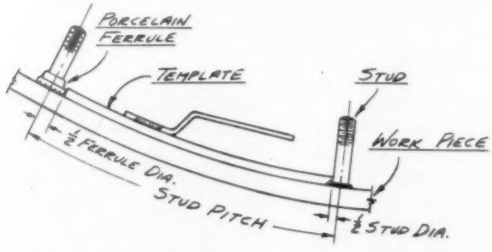
Uses of templates



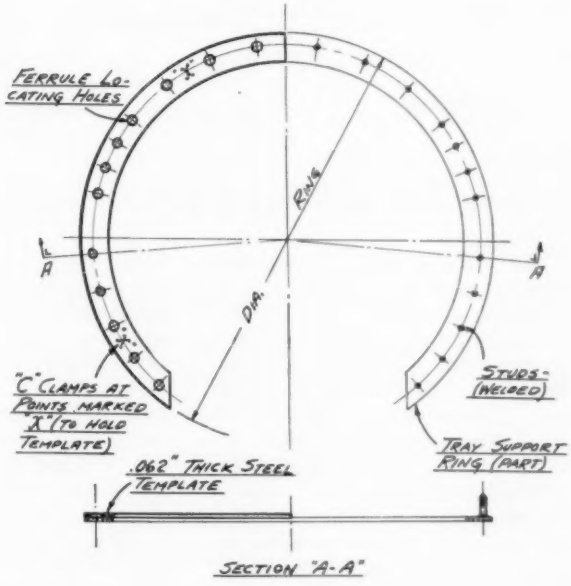
EXAMPLE I - FLEXIBLE BAND-TYPE MARKOFF TEMPLATE



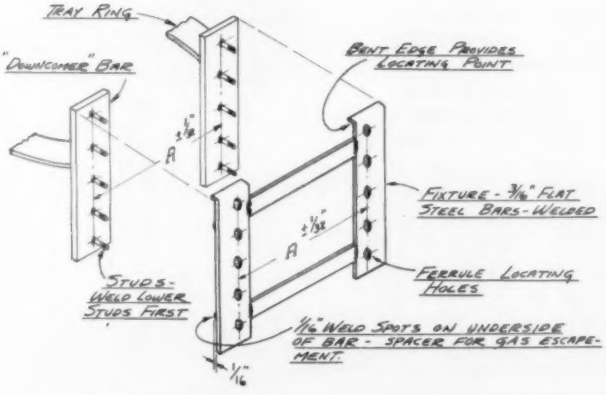
$$\text{TEMPLATE LENGTH} = \text{STUD PITCH} - \left(\frac{\text{STUD DIA.} + \text{FERRULE DIA.}}{2}\right)$$



EXAMPLE II - STUD SPACING TEMPLATE

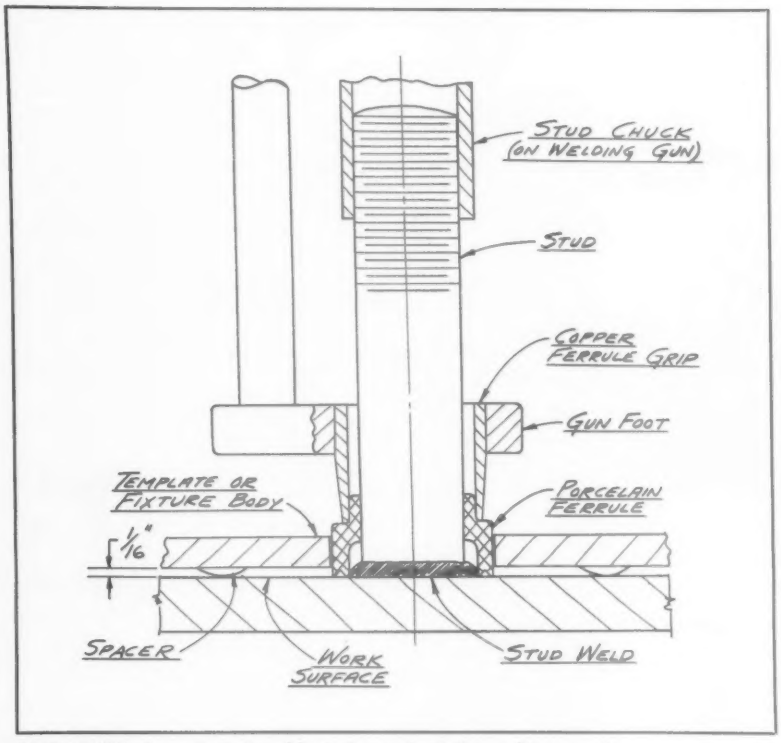


EXAMPLE III - STUDDING A TRAY SUPPORT RING


TRAY RING
"DOWNCOMER" BAR
BENT EDGE PROVIDES LOCATING POINT
FIXTURE - 3/16" FLAT STEEL BARS - WELDED
FERRULE LOCATING HOLES
STUDS - WELD LOWER STUDS FIRST
1/16" WELD SPOTS ON UNDERSIDE OF BAR - SPACER FOR GAS ESCAPEMENT
1/16"

EXAMPLE IV - FIXTURE TO STUD "DOWNCOMER" BARS

for stud welding



CUT-AWAY view of stud weld at the end of the welding cycle.

The best technique, even on small quantity production, is the use of templates or fixtures.

Simplest of all tooled fixtures is a template with ⅛ in. guide holes designed to indicate desired stud position. The template is held over, or clamped to, the workpiece. Stud pattern is marked through guide holes by a center-punch.

Mass production, close tolerances and automation demand complex designs for positioning fixtures. As a general rule, however, the average job can be handled with inexpensive and simple templates made of tin, sheet metal, or steel flats. These fixtures are easily fabricated in the shop and require a minimum of design and pre-planning.

Obviously, accurate positioning for stud welding is not a complicated procedure and can be developed for most operations. Some examples of templates and fixtures, as applied to actual operations, may help clarify their purpose.

Angled Studs

The template shown in Example I was made to locate a series of studs fixed at a 45-deg angle to an existing fillet weld. The template was formed from flexible band steel stock. Notches were cut into it at intervals to indicate stud placement. A hook on one end holds the piece firmly in position (design of the hook was—and is—determined by the form of the piece being welded).

When the template is in position, the operator marks off stud locations with a soapstone. (A center-punch can be used, depending upon degree of accuracy required.) The final step is the removal of the template and actual welding. Because of its flexibility, the template is adaptable to circumferential and irregular shapes, as well as the flat plate on which it is used.

Example II depicts a spacing-bar template that is used to locate equally-spaced studs on the inside of a cylindrical steel section. Spacing is done on a previously marked layout line.

A formed flat bar is cut to the length desired between studs, and a handle is tack-welded to the bar. After the first stud has been welded, the operator breaks off its porcelain ferrule. The next stud is positioned by fitting it against the free end—the bar can be notched for greater accuracy of placement.

This kind of template is also useful on external cylindrical and on flat plate work. But it has been especially advantageous for conical and odd-shaped sections when pattern irregularity permits only partial layout.

Supporting Rings

A sheet steel template was used in Example III for locating tray-fastening studs on a supporting ring. This is a usage frequently encountered in the fabrication of towers and columns for the petroleum and chemical industries.

Cut in the shape of a partial ring, the template contains holes at the points where studs are to be located. Covering half the part, the template is held in position with a pair of C-clamps. To weld the other half of the piece, the template is reversed.

Down-comer bars are flat plates that usually fit in the cut ends of the tray-support rings described above. Example IV illustrates the ⅛ or 3/16-in. flat steel bars used as templates for this kind of stud welding. The bars are bent and tack-welded. Since locations call for close tolerances between the two rows, the down-comer bars were joined to the tray ring after the latter had been welded. Gaps for gas escape were formed by a few spots of weld metal placed on the underside of the template.

The Champion Rivet Company relies on

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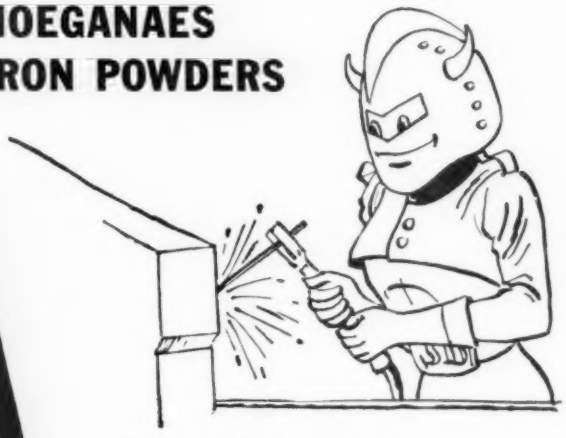

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ELECTRODES

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Manufacturers and large production users alike expect and receive many advantages and savings when they specify Hoeganaes Iron Powders.

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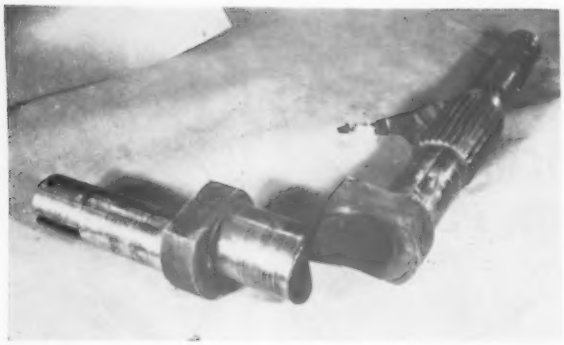
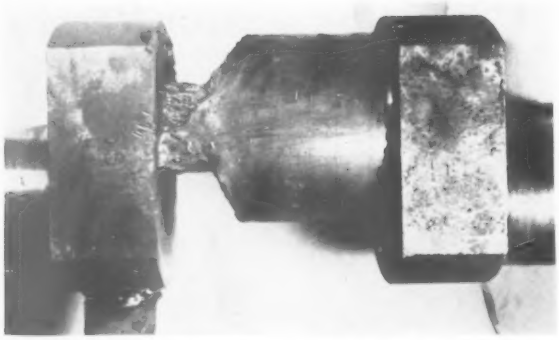


BROKEN crankshaft before repair. Welding renews the shaft and permits longer usage, plus saving 40-50% on purchase of new shaft.



FIRST step in rejuvenating a crankshaft. Pieces are tack welded to hold together while further work is being done.

Call Dr. Christian . . .

Broken crankshafts renewed by these welding physicians

By Thomas W. Campbell, and G. R. Van Dreumel*

BROKEN CRANKSHAFTS are like broken legs—no good to anyone unless they are repaired.

And this is what Industrial Welding & Brazing Co. does: repairs broken crankshafts (but not, however, broken legs). A crankshaft rejoined by welding, the company says, gives long service life and generally saves the user from 40-50% of the cost of a new unit.

Most frequent customers for this service are some of the major automotive manufacturers and forging and stamping companies throughout the Midwest.

Volume Rejuvenation

And well they might be customers. For each year the firm's plant in Lansing, Mich., reclaims 750 to 1,000 shafts, ranging in size from 1-in.-diameter bearings to 10 ton units having 25-in.-diameter. These repairs are greatly simplified by the extensive use of welding.

First step in working on broken shafts is the alignment of the parts as closely as possible. Once aligned, the sections are tack-welded to hold them together during other operations.

The tack-welded portions are placed on roller horses and counterbalanced by welding steel scrap pieces to the cheeks. Because of this counterbalancing, shafts can be turned or stopped in any position as an aid to further repair.

Electrode Specifications

Immediately all radii are spot heated with a torch to reveal hitherto invisible cracks. After a crack is discovered, it is veed out with an oxyacetylene cutting torch. If, however, a break goes completely through the piece, the flaw is veed out on both sides. Flame from the torch during this process serves to preheat the shaft for the welding that is to follow.

The electrode used to fill the prepared vees is an AWS grade E-10016. This is a low-hydrogen electrode, containing 1.75-2.25% manganese and 0.30-0.60% molybdenum. It was developed specifically for welding high tensile steels with high hardenability.

In fact, the crankshaft weld has a higher tensile strength than the original steel. Ratings for the tensile strength range from 105,000-110,000 psi, with a minimum yield point of 94,000 psi. Stress relieving, performed at 1,150 F, alters these values to 103,000-106,000 psi tensile strength, and the psi yield strength is 90,000-95,000.

Ductility is excellent. Elongation is between 18-23% in 2 in., and stress relief increases the figures to 19-24%.

Usually, ¼-in.-diameter electrodes are employed. Smaller shafts, however, require 3/16-in.-diameter electrodes.

Power Ratings

Both electrode sizes can be used with either a-c or d-c reverse polarity. Power for the larger electrode is best between 300-325 amps and 22-24 volts. Amperage for the 3/16-in. electrode runs from 160-225 and volts from 21-23.

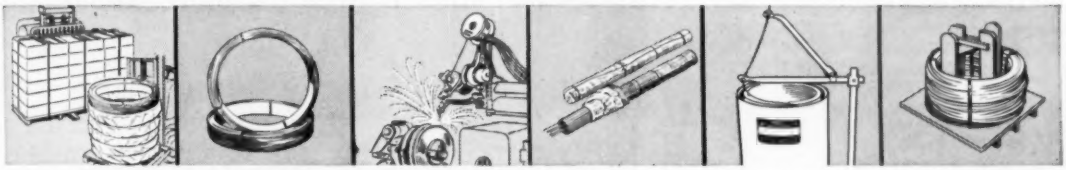
When veed out portions have been filled, bearings and machined surfaces are measured. Any variations from original dimensions indicate the surface must be built up. Resurfacing and build-up is done with an E6012 electrode. A ¼ in. layer is deposited

*Mr. Campbell is purchasing agent of Metal & Thermit Corp., and Mr. Van Dreumel is a sales engineer.

PAGE Welding Wire

The RIGHT Packaging for the RIGHT Wire

• When you choose PAGE Welding Wire, you are assured of getting the exact wire for your application—and receiving it packaged to provide maximum protection and convenience. PAGE has developed a packaging program to cover practically every requirement in the broad fields of automatic, semi-automatic and manual welding. Coils, reels, bundles, cartons, Leverpaks, Payoffpaks, Payoffpallets... PAGE has them all! Look to PAGE for the *right* packaging of the *right* wire.



Wrapped Coils—Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want

PACKAGING ↓ / PAGE WIRE for →	Gas-shielded consumable electrodes: Automatic Welding	Gas-shielded consumable electrodes: Semi-Automatic Welding	Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire: Manual Electric Welding	Straight and cut lengths Bare wire: Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✓	✓	✓	✓		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✓	✓	✓	✓		
120 or 180 lb. (22″/24″ I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✓			✓		
Special coil sizes (on application).	✓	✓	✓	✓		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✓	✓	✓	✓		
Leverpaks, 15″ dia., 25-lb. coils (12″ I.D.x2½″ wide); Leverpaks, 17″ dia. 50/60-lb. coils (12″ I.D.x4″ wide).	✓	✓	✓	✓		
Payoffpaks: 20″ dia. size holds up to 500 lbs.; 23″ dia. size holds up to 700 lbs.	✓	✓		✓		
Payoffpallets, holding 900-1200 lbs. of wire (3/16″ to 3/8″ sizes, incl.) coiled around pedestal on a wooden pallet.				✓		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36″ lengths.			✓			✓
Fibreboard cartons, containing 10 lbs. of rods in 36″ lengths; single or boxed. 50# and over.			✓			✓
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14″ and 18″ lengths.			✓		✓	

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PAGE covers the field of applications with *33 different analyses:* heavy automatic submerged arc..light manual submerged..inert gas manual...automatic, tungsten or metal arc, and oxy-acetylene gas welding.

Look to PAGE for your needs for automatic welding wire, gas welding rods, bare electrodes or metal spray wire.

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PAGE welding wire and rods are available from your nearby PAGE Distributor or PAGE warehouse stocks (*see list at right*).

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Send for These...

- **Folder DH-402A** PAGE Submerged Arc and Inert Gas Welding Wire
- **Booklet DH-1277** PAGE Gas Welding Rods
- **Welding Rod Comparison Chart**

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TULSA **RIverside 2-4783**
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When you need a Eutectic District Engineer for on-the-spot assistance, you'll get immediate action by any of these centers.

EUTECTIC WELDING ALLOYS CORP.
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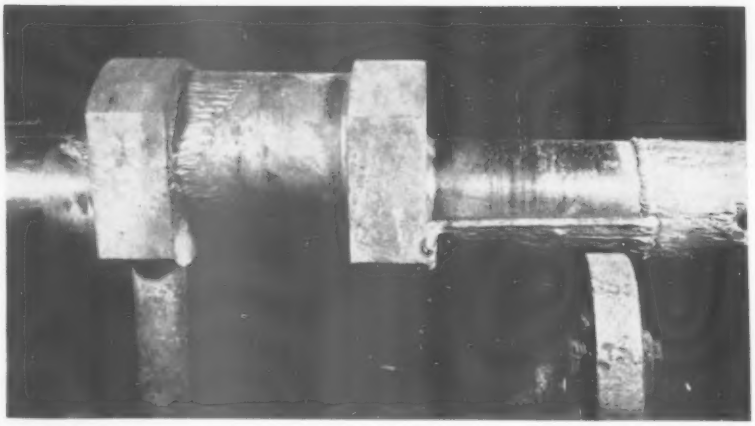
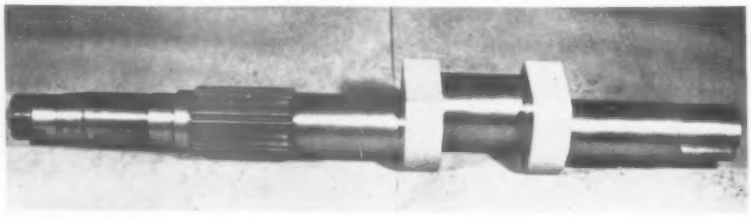


HERE weld metal has been deposited on the shaft preparatory to machining. The next step will form shaft to exact size of unbroken piece.



FINISHED piece shows craftsmanship of weldors. From 750 to 1,000 shafts are repaired each year.

by the electrode, which operates on either d-c, straight polarity, or a-c.

A wide range of currents can be used with a 1/4-in electrode of this type. No breakdown of coating nor harmful physical effects result even though amperage goes as high as 500. Like the E-10016, this electrode can be used in any position.

The limited penetration of these electrodes is a definite advantage when working with high carbon and many low alloy steels. Because of the limited penetration, dilution of the weld with carbon or other alloying elements in the parent metal is held to a minimum. As a result, cracking danger is reduced.

Built-on Furnaces

When—if necessary—the surface has been built-up, a steel furnace is tack-welded around the crankshaft in order to heat treat it.

Charcoal is added to the furnace and temperatures are raised to 500 F. Subjected to eight hours of this heat, the shaft is allowed to cool in the furnace before it proceeds to the next operation—machining.

Meanwhile, annealing has removed all stresses in the shaft caused by past use and welding. Grain structure is restored to normal state.

Before the shaft is machined, however, a steel block is welded to one end and is chucked into the face plate of a lathe. By so doing the length of the crankshaft can be cut without having to reverse its lathe position.

Machining

After it has been positioned in the lathe, the shaft is measured for alignment. Should distortion be too great, the shaft must be straightened by applying heat through propane torches. Heat having been applied to the piece, it is straightened with hydraulic jacks.

For machining operations, a counterbalance is again welded to the cheeks. Through this counterbalance, speeds can be increased, reducing machining time and improving the finish.

While the work is in the lathe, keyways and flat surfaces are milled with a portable machine. Not until the crankshaft is completely reclaimed is it taken from the lathe.

The next time you are tempted to scrap a crankshaft; remember, it *can* be saved.

Plant, Research Laboratories and World Headquarters

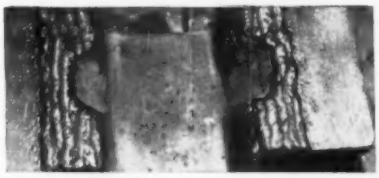
BETTER ORIGINAL FASTER
Low Temperature EUTECTIC WELDING ALLOYS
STRONGER WELDS

EUTECTIC Welding News

PUBLISHED BY EUTECTIC WELDING ALLOYS CORPORATION, 40-40 172 STREET, FLUSHING 58, NEW YORK, N. Y.

FAST OVERLAY FOR CAST IRON DIE— LOWER COST— LONGER SERVICE

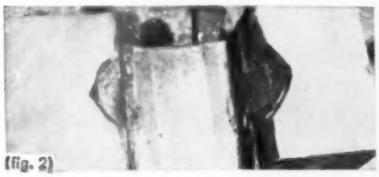
Constant use was wearing away large cast-iron forming dies used by a Canadian railway car manufacturer. The company wanted any repair to be harder than the cast-iron itself.



(fig.1)

A "Eutectic" District Engineer was consulted, and recommended that the forming dies be rebuilt by overlaying with EutecTrode 130 (AC-DC).

EutecTrode 130 (AC-DC) is specially designed for a hard overlay on cast iron and steel which is subjected to constant wear. Its "Frigid Arc" coating helps produce deposits with a hardness of Rockwell C45-47 as deposited: at lowest temperatures. Slight peening and multiple layers increases this hardness to RC 62! Deposits are smooth, dense and offer exceptionally high resistance to wear and corrosion. The low welding temperatures possible with all "Eutectic" alloys avoids the difficulties of embrittlement and warping, common when conventional high heat welding materials are used on cast iron.



(fig. 2)

Figure (1) shows the building up process with EutecTrode 130 (AC-DC) well on its way. In figure (2) the die is in the final stages of being refinished with this superior alloy. The manufacturer was astonished at the results obtained. After two months of constant use the forming die blocks show virtually no wear. *(B-16)*

HIGH-HEAT DISCOLORATION ELIMINATED ON STAINLESS STEEL

The high heat needed with conventional silver solder caused discoloration of a new stainless steel mixing valve. This forced the manufacturer into an extra grinding and polishing operation, which considerably increased the unit cost.

On a regular shop call the "Eutectic" District Engineer suggested EutecRod 1801.

EutecRod 1801 is a universal, low-melting silver type alloy with a high tensile strength of 90,000 psi...a perfect combination for stainless steel. It is ideally suited for delicate parts and light gage metals. Tests with EutecRod 1801 showed that the lower heats possible with this "Eutectic" alloy eliminated the troublesome discoloration. Faster joints were possible too, because of the thin flowing properties of this highly developed alloy. The finished joint was strong, leakproof and corrosion resistant.

Now, using EutecRod 1801 to assemble his mixing valves, the manufacturer reports that the elimination of extra polishing and cleaning, as well as increased production, effected savings of $15,000 a year. *(B-17)*

NAVY SeaBees LEARN NEWEST ANTARCTIC WELDING TECHNIQUES

A U.S. Navy Construction Training Unit was recently instructed in the latest "Low Heat Input"® metal joining methods and alloys by a demonstration team from Eutectic Welding Alloys Corporation. The training unit was part of a Steel Working School at the Rhode Island SeaBee Construction Base. The "Eutectic" demonstration emphasized techniques and alloys specially suited for below zero service conditions. SeaBee construction crews will soon leave for the Antarctic in preparation for the U.S. Navy's participation in the 1958 International Geophysical Year.

Special attention was directed at EutecRod 21 and EutecTrode 2101 (DC Reverse).

EutecRod 21 is a torch aluminum alloy for high strength fillet and bead joints on wrought forms, extrusions and cast aluminum...ideal for architectural and general building use. EutecTrode 2101 (DC Reverse) is a new, patented electrode with *extruded* "frigid arc" flux coating. Designed for heavier aluminum castings, long joints, filling defects and overlaying, its *extruded* coating makes it easy to control. Both of these alloys have been found highly adaptable to sub zero service conditions. *(B-18)*

Q. Please give us procedure for rebuilding and hard surfacing manganese pressure jaws on gravel crushers. Conventional materials always cause distortion and buckling.

A. Manganese jaws of this type can be surfaced with EutecTrode 2 as is, or followed by subsequent layers of EutecTrode 12. For maximum impact resistance, we suggest padding of either EutecTrode 4 or EutecTrode 680 applied directly to the manganese jaws, over which apply EutecTrode 12.

Q. We would like information on overlaying nickel-manganese parts of our shot-blast unit.

A. Assuming the overlay is subjected to heavy impact in service, we would recommend EutecTrode 4. Apply directly to the nickel-manganese parent or, for extremely heavy sections, after a preheat of 500°F. Under certain conditions it is desirable to apply EutecTrode 680 directly to the nickel-manganese base metal without preheating and build up with subsequent layers of EutecTrode 4.

Eutectic Welding Alloys Corporation
40-40 172nd Street, Flushing 58, N.Y.

Gentlemen:

I would like further free information on the following:

☐ **B-16** ☐ **B-17** ☐ **B-18**

☐ **Free: New 1958 180 page pocket Welding Data Book.**

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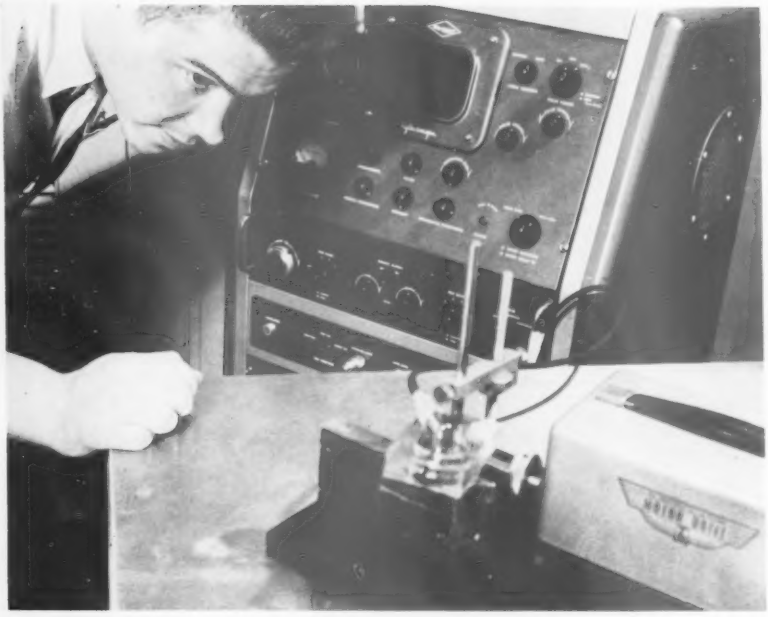
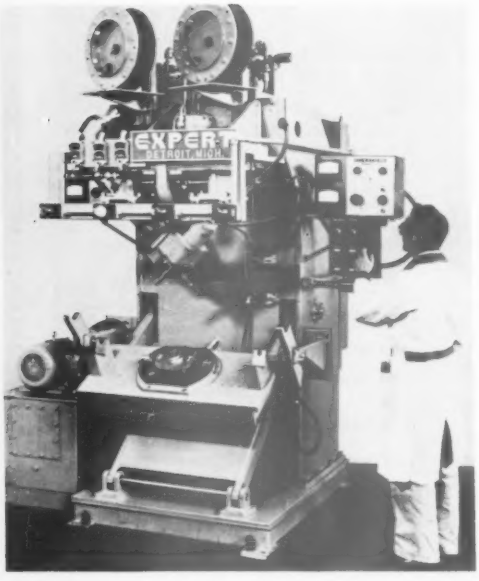
"EUTECTIC" WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS



LEFT: At Caterpillar's new Production Metallurgical and Materials Testing Laboratory in Peoria, Ill., ultrasonic testing is used to check weld soundness. Instrument here, called a reflectoscope, detects internal defects, inclusions, and cracks. Thickness, elasticity and grain size are also determined by the unit.

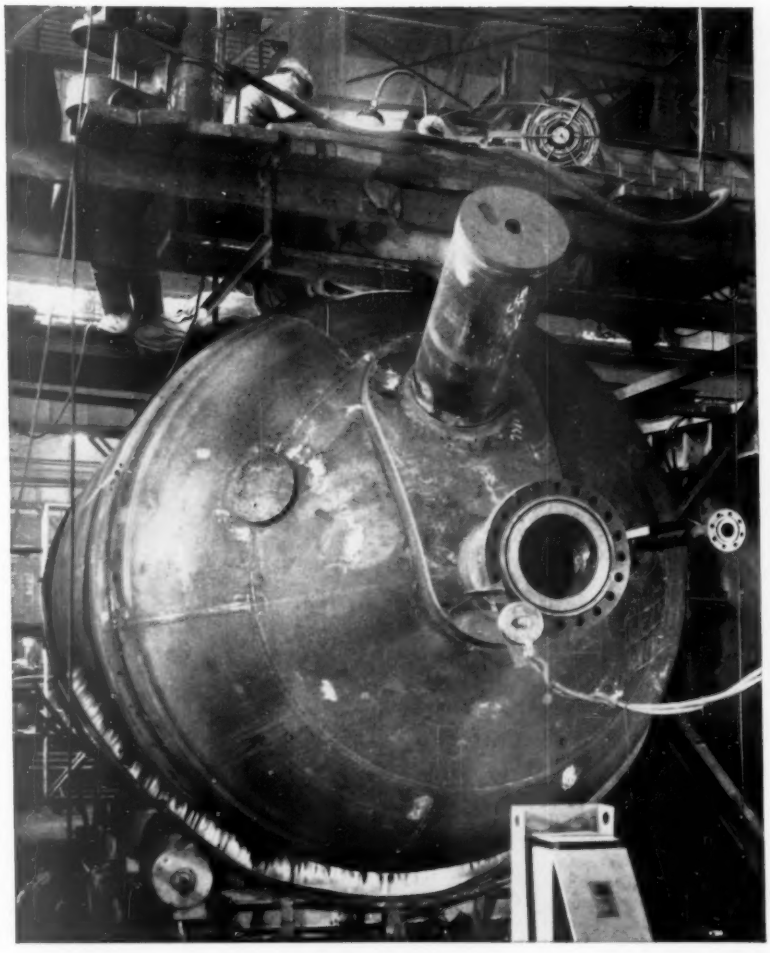
BELOW: Two technicians of Cleveland Welding Div. of American Machine & Foundry Co. prepare to X-ray a bundle of 403 stainless steel rings. Used on jet engines, rings are examined by a Norelco 300 kv constant potential machine. Only two exposures are necessary to inspect the stack.

On the job...



WELDING on the *inside* of tubular parts is done by this single-station automated welder. Expert Welding Machine Co., Detroit, states it produces 250 welds inside banjo sections on rear axle housings, each hour. Flux-cored wire turns the trick.

PARTS flexibility for submerged-arc welding is gained by Dix Engineering, which drilled 36 bolt holes in fixture and lined them with torque and wear-resistant threaded stainless inserts.



When fabrication codes demand 100% X-ray inspection...

SPECIFY *Drawalloy* CORPORATION

Stainless Steel Welding Wire

In hundreds of applications, *Drawalloy* wire has been put to the test . . . X-ray, dye check, pressure and service and with the same consistent result—OK as welded. That's why Frank Iapalucci, Manager of Welding Engineering for Baldwin Lima Hamilton, Eddystone, Penna., selected *Drawalloy* chrome-moly wire for the automatic welds on this reactor. The vessel is constructed of A 301-54T Grade B firebox quality steel ranging in thickness from 5-1/16" to 2-5/8". *Drawalloy* 1-1/4 Cr, 1/2 Mo wire was used for all submerged arc joints.

When inspection by X-ray is required, don't gamble . . . rewelding is expensive . . . specify Drawalloy "quality controlled" wire. *Drawalloy* stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for smooth operation in your equipment and to provide X-ray quality welds.

Why not discuss your stainless welding wire needs with your *Drawalloy* Distributor or Representative . . . a man ready to help you. Bulletin 355-DC provides complete information on every grade of *Drawalloy* wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

DRAWALLOY
CORPORATION
YORK, PENNSYLVANIA

THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL

To prepare new crushers for a hard life, Wasco County, Oregon, hardfaces rollers with Victor alloy rod. The rollers showed no discernible wear after crushing 3100 tons of extremely hard and abrasive basalt.

Lifesaver for new or used equipment **VICTOR Hardfacing Alloys**

Wasco County, Oregon, uses lots of crushed basalt. This rock crushes readily, yet is extremely hard and highly abrasive, consequently tough on rollers. So, as standard practice, Supt. Wayne Weeks hardfaces all rollers in brand new crushers, before ever they crush a single basalt rock. He reports hardfacing of new equipment prevents excessive wear of surface material, thus maintaining roller size during the work hardening period.

On this new crusher, he used 200 lbs. of Victor #0 semi-automatic wire, size 7/64", to hardface roller faces, and 50 lbs. of tube Victorite coated for finish work around the roller edges. Longer crushing life will quickly pay for the rod.

You, too, can save money and extend the life of equipment subjected to abrasion, impact and heat. Simply make it standard practice to hardface both new and worn equipment with Victor alloy rods. Complete line of 27 different hardfacing rods assures you a right rod for every hardfacing need. Full range of sizes for both acetylene and electric AC and DC applications, either hand, automatic or semi-automatic. Order a supply from your Victor dealer TODAY.

FREE Victor Hardfacing Manual shows you right rod to use and how to apply it. Write us NOW for your copy.

VICTOR for welding

Profitable dealerships open; inquire now!

VICTOR EQUIPMENT COMPANY 42

ALLOY ROD AND METAL DIVISION

13808 E. Imperial Highway, Norwalk, Calif. • Wakita, Oklahoma

Resistance welding

Cable performance data

300 MCM CABLE

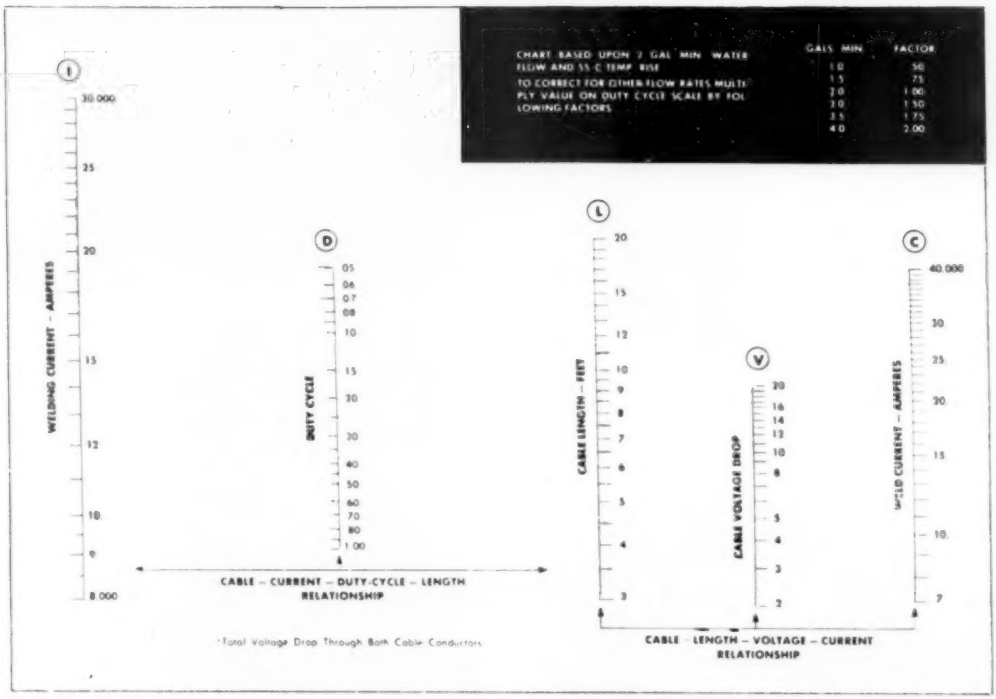


CHART BASED UPON 2 GAL MIN WATER FLOW AND 55 C TEMP RISE
TO CORRECT FOR OTHER FLOW RATES MULTIPLY VALUE ON DUTY CYCLE SCALE BY FOLLOWING FACTORS
GALS MIN FACTOR
1 0 50
1 5 75
2 0 1 00
3 0 1 50
3 5 1 75
4 0 2.00
WELDING CURRENT – AMPERES
DUTY CYCLE
CABLE – CURRENT – DUTY-CYCLE – LENGTH RELATIONSHIP
CABLE LENGTH – FEET
CABLE VOLTAGE DROP
WELD CURRENT – AMPERES
CABLE – LENGTH – VOLTAGE – CURRENT RELATIONSHIP
*Total Voltage Drop Through Both Cable Conductors

NOTE—Uniflex has constructed these voltage drop charts employing the inpedance at the maximum operating temperature of 70°C.

To determine voltage at 20°C, the basis used by some manufacturers, divide the derived voltage by 1.15.

400 MCM CABLE

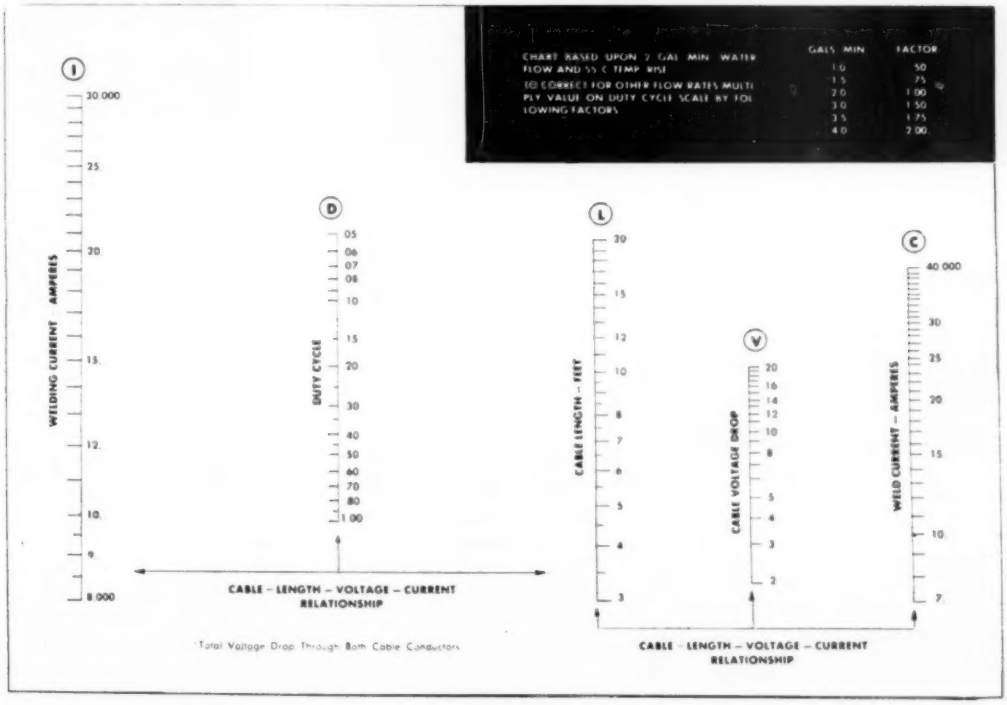


CHART BASED UPON 2 GAL MIN WATER FLOW AND 55 C TEMP RISE
TO CORRECT FOR OTHER FLOW RATES MULTIPLY VALUE ON DUTY CYCLE SCALE BY FOLLOWING FACTORS
GALS MIN FACTOR
1 0 50
1 5 75
2 0 1 00
3 0 1 50
3 5 1 75
4 0 2.00
WELDING CURRENT – AMPERES
DUTY CYCLE
CABLE – LENGTH – VOLTAGE – CURRENT RELATIONSHIP
CABLE LENGTH – FEET
CABLE VOLTAGE DROP
WELD CURRENT – AMPERES
CABLE – LENGTH – VOLTAGE – CURRENT RELATIONSHIP
*Total Voltage Drop Through Both Cable Conductors

—Courtesy Uniflex Cable Div.

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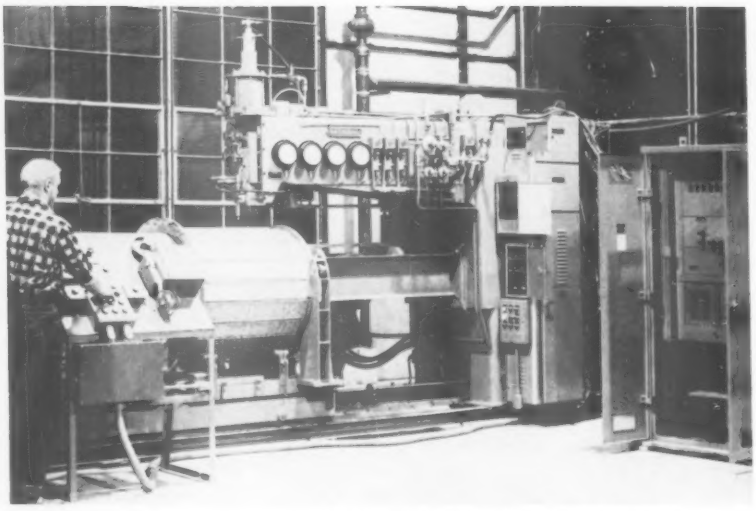


COMPLETE set-up for tab welds on liners for jet engines. Tape punched with numerical control information can be seen next to operator's control panel.

automation at work . . .

Spot welds and tape create an 85% savings

WHAT IS REPORTEDLY the nation's first automatically-programmed resistance welding machine is now in operation at General Electric Co.'s small aircraft engine dept. in Everett, Mass.

The unit, which is said to reduce assembly and weld time by 85% in joining tabs to cylindrical liners for jet engines, is the result of a cooperative venture by National Electric Welding Machine Co. and G-E.

Savings of about $25,000 annually in jet engine manufacture are expected through use of the machine, which uses G-E's numerical positioning and resistance welding controls. The welder itself is a National Electric product.

Punched Paper Tape

Automatic parts positioning and precisely timed welding operations are the results of this combination. Punched paper tape contains all information necessary for full operational control.

The tape contains numerical information to position the liner: to select three values of weld current and two values of weld time; to indicate when electrodes need cleaning; to make sample welds, and to inspect welds. Tape may also contain instructions for cooling electrodes with a jet of water.

Spot welding current can be increased gradually due to a special slope-control unit in the synchronous resistance welding control panel. This action reduces harmful welding effects caused by any sudden surges of current.

1,600 Welds

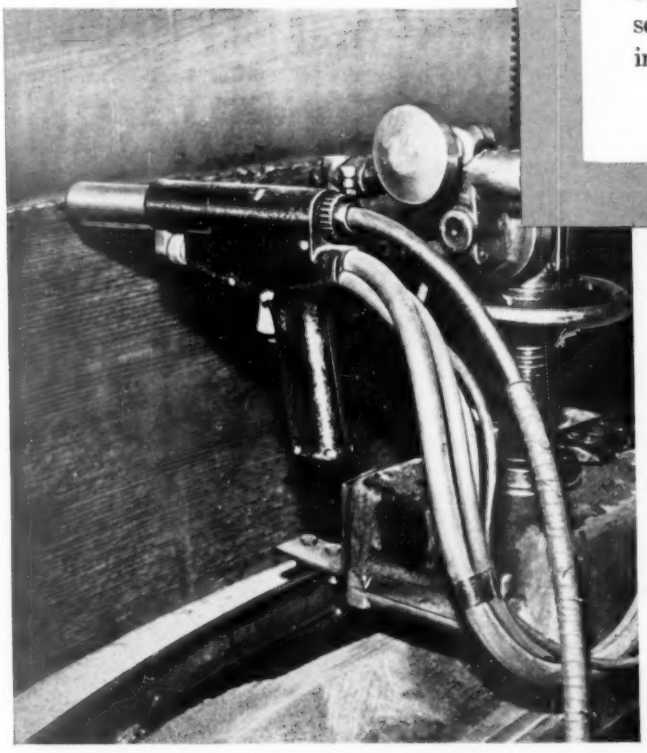
Work on the cylindrical liners involves welding a series of tabs along the surface of the unit, parallel to its axis. Depending upon tab length, there may be from one to three spot welds on each; a total of 1,600 welds are required on each liner.

When the final tab weld has been made, a light at the operator's control station signals the end of the run.

Each weld is made in approximately 3½ seconds—including positioning time between welds. With this automatic set-up, welding time on the liners has been reduced from 9½ hours each to just 1½ hours per liner.

Crucible Stainless Automatic Welding Wire for *cleaner, faster, sounder welds*

Crucible stainless automatic welding wire is quickly available from local stocks—in the widest range of analyses. It's packaged to fit your needs—in spools or layer wound coils.



This is the interior wall of a kraft digester used in a leading pulp mill. A stainless weld overlay is applied automatically by the inert gas consumable electrode process. 6,000 pounds of Crucible Rezistal stainless, overlay welding wire 1/16" was used to cover 1,400 square feet of area. The cost: one-third that of vessel replacement.

Next time you need welding wire—call Crucible. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

Danny says:

"Airco 90B Electrodes are tops for all-'round welding"

I use the 90B as a general purpose rod because of the ease of application and excellent appearance of the deposit. The mechanical and impact properties are outstanding for this class of electrode. Welds show uniformly feathered edges. Slag removal is complete and easy.

Why not send for the free Airco Electrode Guide which will help you select the right electrode for your specific job. Request catalog 1318.

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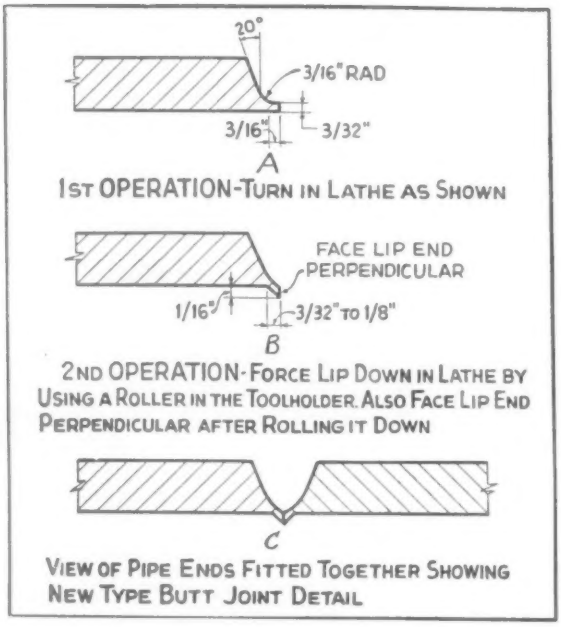

20°
3/16" RAD
3/16"
3/32"
A
1ST OPERATION-TURN IN LATHE AS SHOWN
FACE LIP END PERPENDICULAR
1/16"
3/32" TO 1/8"
B
2ND OPERATION-FORCE LIP DOWN IN LATHE BY USING A ROLLER IN THE TOOLHOLDER. ALSO FACE LIP END PERPENDICULAR AFTER ROLLING IT DOWN
C
VIEW OF PIPE ENDS FITTED TOGETHER SHOWING NEW TYPE BUTT JOINT DETAIL

MANNER of preparing root edges of beveled pipe for Mig welded root pass.

Boston firm develops:

New method for root welds on piping

A NEW TECHNIQUE for producing sound, uniform root-pass welds on piping for critical use has been developed by Stone & Webster Engineering Corp., Boston, Mass.

Major feature of the method, which is the brainchild of an S & W metallurgical engineer, R. T. Pursell, is the manner in which root edges are prepared for welding. Pipe is placed in a lathe after beveling and a roller in the toolholder forces the lip down *(see sketch)*.

The Mig (metal inert-gas) welding process is applied to the butted lips for the root pass; later passes are made with the submerged-arc process. S & W has found that an inert-gas atmosphere eliminates the concave condition associated with fixed-position yield welds.

Another innovation of the process is the method of burning up the paper dams with an oxyacetylene flame or stress-relieving coils.

The Boston firm is using the procedure on construction jobs throughout the world where pressure piping for power, chemical, petroleum and nuclear installation is needed. Experience to date indicates that costs will be lower than, and quality superior to, other techniques which utilize metallic backing rings or inserts.

FINISHED pipe joint shows smooth submerged-arc beads on outside, and uniform root pass weld.

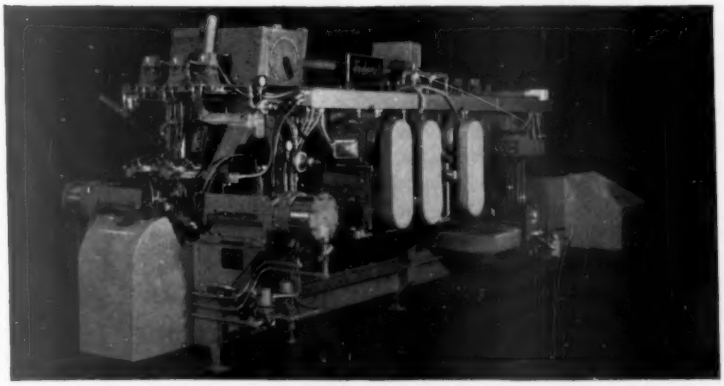
one-source production lines spark interest of volume producers...

The prospect of ordering an entire production line, ready made to produce a part to specification, has arrested the interest of many of the nation's top production engineers.

One source responsibility assuring better service; a line 100% harmonic, all stations engineered to work in perfect synchronization; integrated and automated handling of work in process; utilization of common drives and bases, reducing operating costs and floor area, are some of the advantages of the packaged line that has production people talking.

Federal/Warco pioneered the packaged line and have already produced automated lines combining such operations as blanking, forming, drawing, welding, machining, drilling, assembling on a common base.

For additional information contact the Federal/Warco representative nearest you or write direct.



This Federal Packaged Production line welds, spot faces, reams, de-burrs, sets six bolts and welds them in place . . . ejecting finished pedal brackets at a rate of 775 pieces per hour.

Federal / Warco
PACKAGED
PRODUCTION LINES

THE FEDERAL MACHINE AND WELDER COMPANY - WARREN, OHIO

422

AFFILIATED WITH BERKELEY-DAVIS, INC., DANVILLE, ILLINOIS, MANUFACTURERS OF AUTOMATIC ARC WELDING EQUIPMENT.

PHILLIPS PETROLEUM'S Refinery at Borger, Texas has several of these banks of WELDREEL welding hose and cable reels. Plant safety is improved—hose and cable life is extended—good housekeeping is made simpler—by keeping hose and cable off the floor when not in use—with WELDREELS.

WELDREEL reels pay out freely and lock automatically at desired length. A slight tug releases the locking pawl allowing hose or cable to be automatically retracted.

Write for information.

UNITED SPECIALTIES, INC.
P. O. BOX 698 EL DORADO, ARKANSAS

a NEW product means NEW time saving and important NEW production gains

York's
SPAT-R-PRUF
COMPOUND 106

don't sputter about spatter . . .
JUST WIPE IT OFF

Completely eliminates grinding after welding. Just one coat, and spatter can be wiped away with a dry cloth.

- NO STIRRING OR DILUTION
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- HARMLESS TO SKIN
- PERFECT PAINT BASE
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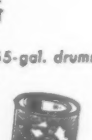
Available 1 or 5-gal. cans, 55-gal. drums

3 in 1 York's '77'
SPECIAL FLUX
FOR GENERAL BRAZING
FOR CAST IRON WELDING
FOR CAST IRON BRAZING



YORK ENGINEERING COMPANY
2711 S. Kedzie Ave. Chicago 23, Ill.

No more juggling acts

An automatic nut feeder speeds auto spot welding

By John Grindrod

BRIGGS MOTOR BODIES, Ltd., Dagenham, England, is achieving a more efficient operating cycle and providing greater safety in manufacturing body panels for British Ford autos.

Effecting these desirable features is a recently-installed automatic device which feeds nuts to a resistance spot welding machine. The threaded fasteners are then welded to sheet metal panels.

The automatic equipment was developed by Rhoden Partners, Ltd., of London. It is mounted on a standard 50-kva air-operated welder.

Ease and Speed

Before installation of the nut-feeding device, a Briggs weldor had to position a sheet metal panel between the electrodes and retain control of it while *accurately* locating one nut at a time for welding. He must still control the panel manually, but he now has both hands for the job. Operator ease and greater production speeds are a natural result.

Included in the automatic equipment is a standard bowl feeder which orients nuts in correct welding position and delivers them in a row to an attachment resembling a breech block. When the upper electrode slide reaches its top position, an air cylinder in the breech block transfers one nut to the entrance of the feed tube.

Compressed air delivers this single nut through the tube and into the jaws of the electrode assembly.

Locating Pin

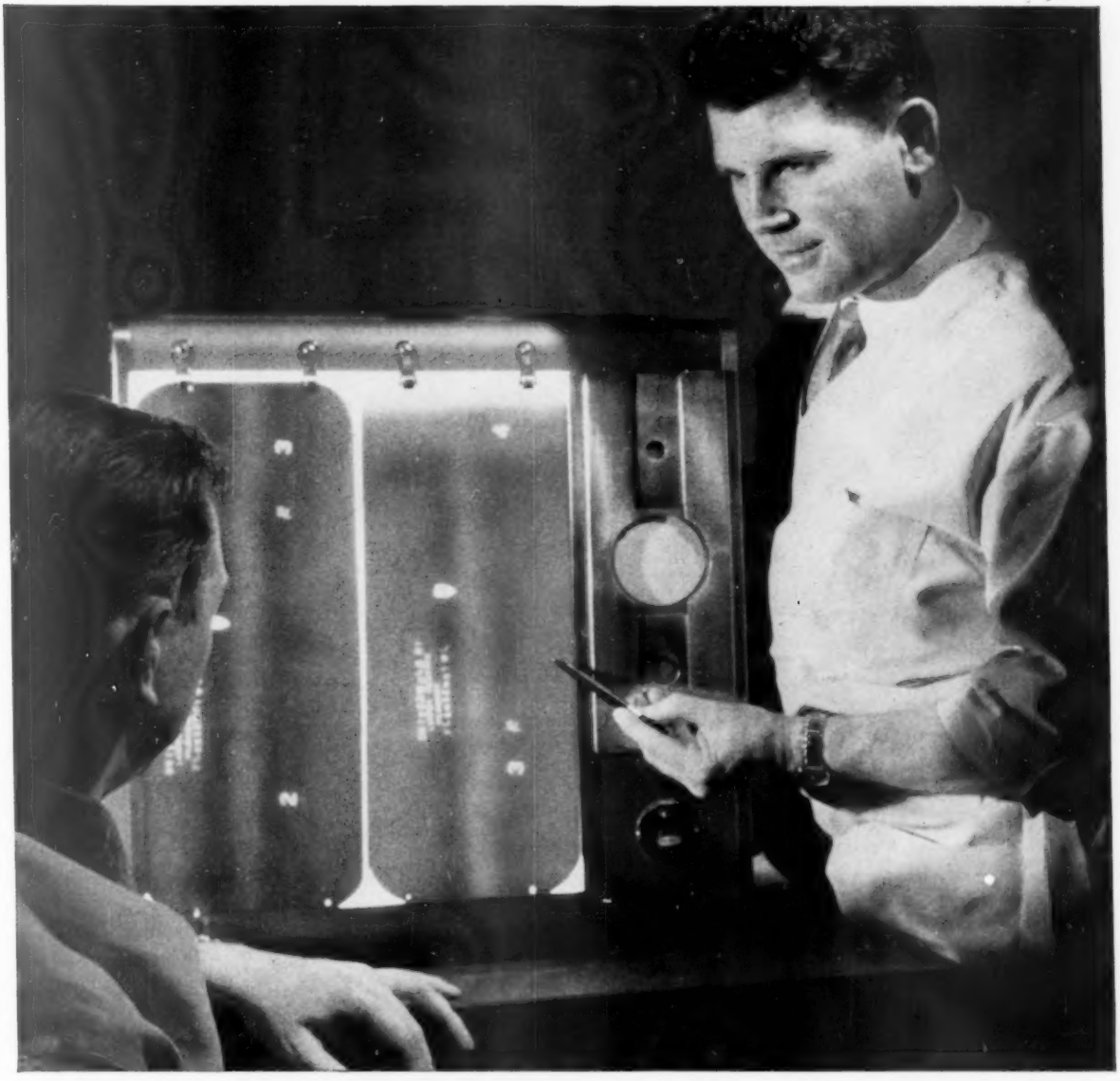
With the panel in position on a locating pin in the bottom electrode, the weldor depresses a foot pedal to initiate the welding cycle. The top electrode descends and carries the nut in the jaws with it until the nut registers on the locating pin and contacts the panel.

CLOSE-UP of feeder-equipped spot welder shows pneumatic tube, nut-retaining jaws and locating pin on lower electrode. Welder is a standard 50-kva unit.

The jaws then open automatically —well clear of the welding area— and the nut is clamped to the panel by the electrode. Forging pressure and welding current are then applied for a pre-set time.

At the end of the welding period, the top electrode is retracted and the jaws close automatically to receive the next nut when the electrode returns to its top position.

Timed in relation to the basic welding cycle, the mechanisms for transporting a single nut and for opening and closing the jaws derive their motions from the original mechanical and pneumatic operations. No additional controlling or working movements have to be carried out by the weldor.



Get X-ray welds on alloy steels!

with P&H Low-Hydrogen electrodes

Here are electrodes that can keep you out of trouble on alloy steels.

P&H low-hydrogen electrodes give superior x-ray welds, with no porosity or cracking. Welds have exceptional strength and ductility through a wide temperature range, with as-welded properties comparable to stress-relieved.

Check P&H low-hydrogen rods for your really tough jobs — you'll find one to match the chemical or mechanical properties of any problem alloy you're handling. Write Dept. 316B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

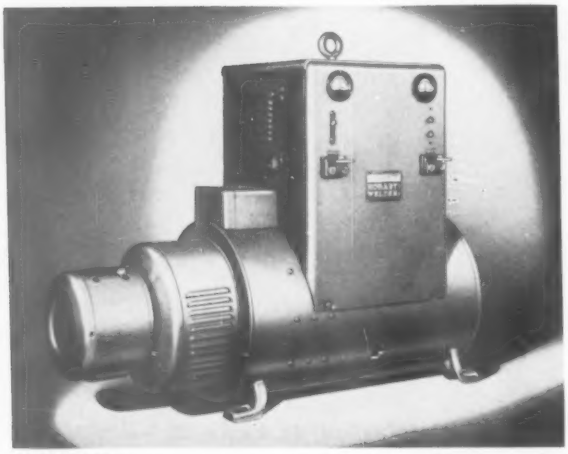
HARNISCHFEGER

P&H WELDERS • ELECTRODES • POSITIONERS

MILWAUKEE 46, WISCONSIN

new products . . . . . USE CARD ON PAGE 119

WEIGHING less than 4 lb and only 9 in. long, this Nelson stud welding gun end-welds all studs through ½ in. in diameter. (See story below.)



DESIGNED as a power source for the carbon-arc and compressed air method of cutting and gouging, this 1,200-amp welder has maximum 1,600 amp output. (See story below.)

Stud welder

SMALL stud welding gun weighs less than 4 lb and measures 9 in. long. The red plastic gun, Model NS-10, will weld all studs up to ½ in. in diameter. It will be demonstrated at the National Metal Congress Nov. 4 through 8. *Nelson Stud Welding Div.*

Circle No. 1

Motorized cutting unit

AUTOMATIC operation in cutting and beveling on pipe is possible with a new motorized unit. The attachment is powered by a fractional horsepower electric motor. Switching from manual to automatic is possible with a quickly detachable mounting bracket. A flexible coupling is used to connect the motor with the crank pinion, which drives the main gear and the cutting torch around the pipe. To operate, set the governor-controlled motor to the required speed, light the cutting torch and turn the switch to the direction of travel. *H & M Pipe Beveling Machine Co.*

Circle No. 2

Cut-off wheel

REINFORCED cut-off wheel for off-hand floor stand and swing-frame applications is being introduced after a year of testing in ferrous and non-ferrous foundries. An improved resin bond gives increased efficiency, manufacturer reports. It is recommended for foundry cut-off work on cast-iron, steel and hard, tough, ferrous and non-ferrous alloys. Diameters from 12 to 20 in. available with hole sizes for all standard floor-stand and swing-frame machines. Thicknesses from ⅛ in. to ¼ in. diameter. *Bay State Abrasive Products Co.*

Circle No. 3

Welder

PORTABLE arc welder is gasoline engine-driven. The new welder, called "K-6090," is rated at 200 amp at 40 volts and 60% duty cycle. It has dual controls for the generator output, an electrical outlet providing 1 kw of auxiliary d-c power, an idling device and is powered by a 36-hp water-cooled engine. Typical applications are pipelines, structural erection, outside repair jobs, intra-plant maintenance. *The Lincoln Electric Co.*

Circle No. 4

Vertical machine

A 9,600-cycle vertical motor-generator combination control and heating station preheats and diffuses automotive valves during aluminizing operations. The unit has: a motor generator, control station for regulating and controlling the application of h-f power, two heating stations to apply h-f power, the inductors for preheating and diffusing the values. A vertical conveyor system wrapped around the 14 ft cabinet moves the valves through their operations and is loaded and unloaded automatically from the shop overhead conveyor. *Lindberg Engineering Co.*

Circle No. 5

Power source

SPECIALLY designed as a power source for the carbon-arc and compressed air method of cutting and gouging all kinds of metals, a new 1,200-amp model machine has a maximum output of 1,600 amp. It is recommended for carbon electrodes over ½ in. in diameter. A wide range of voltage control, along with the self regulating features of the carbon electrode, provides control for all sizes of carbons used in carbon-arc and compressed air cutting and gouging. *Hobart Bros. Co.*

Circle No. 6

Cable splicer

VULCANIZED, neoprene insulated cable splices without power loss can be produced with a new portable cable splicing kit. The 110-volt kit makes permanent cable splices which are flexible, waterproof and shockproof, maker claims. Splices as short as 2 ft can be made with the new kit. Insulation will withstand 2,500 volts without any leakage.

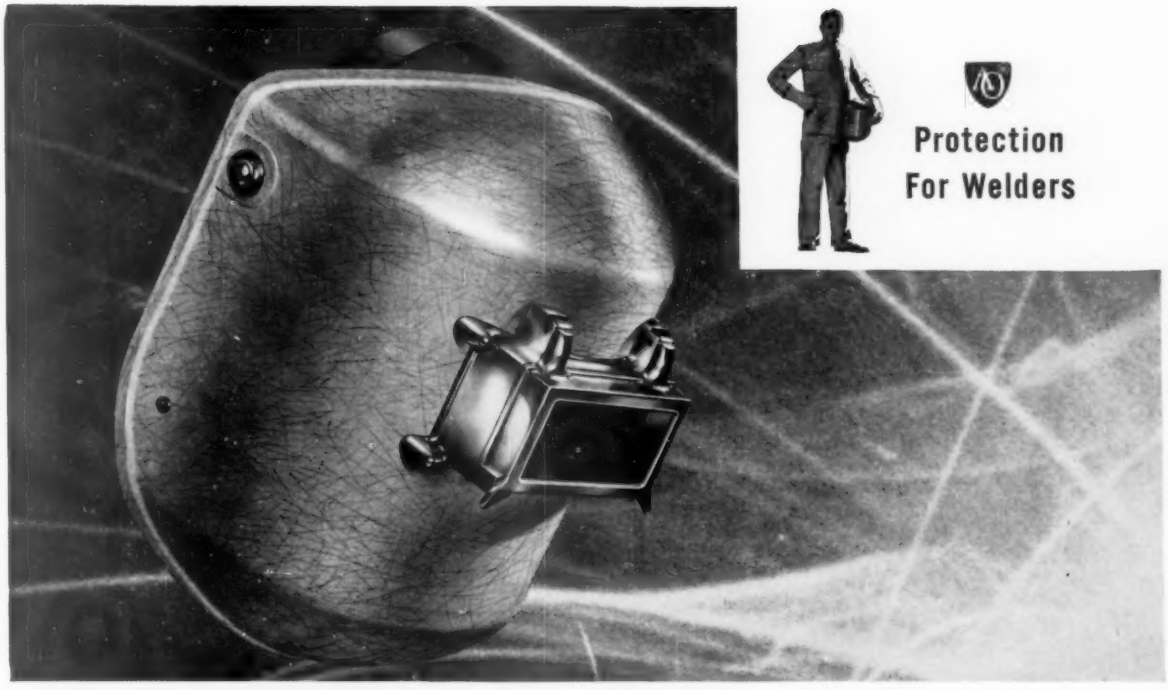
Kit includes crimping press, cable cutter and vulcanizing mold and can be used to make rubber insulated cable connectors. *Cam-Lok Div.*

Circle No. 7

Deburrer

DEBURRING, grinding, sanding and polishing can be done with two pneumatic disc sander-grinders. Model DC weighs 3½ lb and Model D weighs 3 lb. *Detroit Surfacing Machine Co.*

Circle No. 8



Protection For Welders

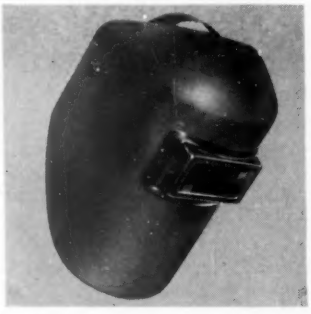
AO "Weld-Cool" the First

WHITE FIBER GLASS WELDING HELMET

. . . Cooler — Reflects 70% of Radiant Heat

Here's the answer to the plea of welders for a cooler helmet . . . AO 9702-W and AO 9706-W Weld-Cool Helmets made of Fiber Glass. Because these helmets reflect 70% of radiant heat from their white exterior surface, welders are 50% cooler and far more comfortable . . . more efficient also! Aluminized plastic coverplate, AO 168AL also available . . . provides exceptional coolness in eye area. Helmet is black inside to eliminate any possibility of diffusion of harmful light rays and to permit easy cleaning. Reflective, cool, aluminum glass holder. All helmets flame resistant. Stationary or lift front. Also available with dark gray shell as No. 9702 or No. 9706.

Quick Facts — *New plastic*, easy floating, rear adjustment, positive lock headgear — locks securely once set to proper head size. • Adjustable friction joint • Exceptional ventilation • Adjustable vulcanized fiber chin rest for easy alignment of helmet in line of vision • Lightweight, exceptionally strong • Nonwarping and moistureproof, particularly recommended for inert gas, shielded arc and outdoor welding.



PREFER VULCANIZED FIBER?

AO Presents 4 Welding Helmets made for the Job!

All 4 helmets have rear positive lock adjustment, adjustable chin strap and friction joints identical to AO Fiber Glass Helmets. All helmets available upon request with Noviweld or Filterweld plates. Helmets dielectric and seamless. No. 944 imitation leather or No. 945 genuine leather sweatband available upon request.

No. 9440 (shown) — Excellent protection for throat, neck and head. Standard aluminum, lightproof glass holder No. 91085 with plastic insert for insulation. No. 94 easy floating headgear with positive lock adjustment.

For complete details on this helmet, other AO Vulcanized Fiber Helmets (No. 9460, 9890 and 9270) and AO Fiber Glass Helmets write for new Brochure S-6311.

AO Sweatbands increase worker comfort and protection, decrease accidents. Check your needs!

American Optical COMPANY
SAFETY PRODUCTS DIVISION

Always Insist on AO Trademarked Safety Products. Your nearest American Optical Safety Products Representative can supply you.

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

Silver flux

BOND of silver solder on stainless steel, Monel, nickel, copper, brass, bronze and steel is increased with "Ag" flux, manufacturer says. It is a low-melting flux with a powerful scavenging action on silver solder, eliminating the time lag between fluidity of the solder and its adherence to the parent metal. Cost is $1.50 per lb. *Farrelloy Co.*

Circle No. 9

Trucks

ALL-WELDED construction and load balanced design are features of a new line of trucks. Designs include the "Uni-Handle" series of cylinder trucks with single column support to handle small and medium cylinders; the continuous handle (dual) design for medium and large cylinders; industrial hand trucks for 300 to 800 lb loads and a novel truck, the "Wheel 'N Reel" to reduce labor of moving reels of welding cables, electrical wire, hose and wire line. *Harper Steel & Supply, Inc.*

Circle No. 10

Whip cable plug

WHIP cables can be attached to lead cables with a new whip cable plug used in combination with a cable splicer. Splicer is attached to lead cable and the whip cable plug is attached to the holder whip lead. The parts are connected by inserting the whip cable plug into the open end of the cable splicer. They are held together by a ball-point screw driven into the concave hollow of the male plug which is split to allow the ball-point screw to wedge the male plug inside the female receptacle of the splicer. A three-quarter turn of the ball-point screw releases the whip cable plug. *Tweco Products Co.*

Circle No. 11

Flux

SILVER alloy flux for aluminum bronze, beryllium copper, stainless steel, brass, Inconel, nickel, etc. Melts at 1,160 F. *Krembs & Co.*

Circle No. 12

Tool hardening unit

UNIT is a combination of small electric furnace and 50 lb of steel hardening compound. The small heat treating unit hardens small tools and parts. A 110-volt or 220-volt a-c electric outlet is required, and a temperature of 1,800 deg attained. *Armor-Tuf Sales Corp.*

Circle No. 13

Grinders

DESIGNED for use in metal grinding, sanding and wire-brushing operations "1500" series grinders are the manufacturer's latest in pneumatic hand tools. Of lightweight construction because of magnesium alloy castings, a special muffler handle reduces noise and serves as air exhaust, eliminating unnecessary holes in grinder casing. Available in variety of speeds and for several different wheel and guard mountings. *Cleco Air Tool Div.*

Circle No. 14

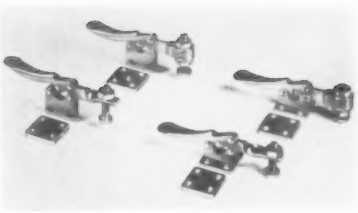
Welder

TRIPLE rated a-c transformer type arc welder is for operation on single-phase, 60 cycles, 230-volt input. Output of the welder at 30 volts is 295 amp on 20% duty cycle, 250 amp on 30%, and 200 amp on 50%. The transformer is the "diverter path" type with magnetic control.

Controls give five main steps of coarse adjustment for conventional a-c welding and certain inert gas welding applications. Four other steps are for use in inert gas welding and conventional welding with E-6013 type electrodes and downhand welding only.

Available with or without capacitors for power factor correction. *Hobart Bros. Co.*

Circle No. 15

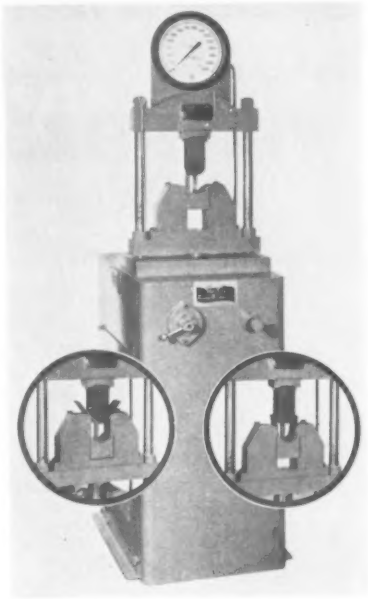


Toggle clamps

FOUR midget "Tiny-Toggles" clamps are only ¾ in. high and 2¾ in. long when closed, yet have a holding pressure up to 42 lb, manufacturer says. Clamps can be used to hold small assemblies during multiple wiring, soldering, etc.

Top models in pictures have U-bars for holding adjustment spindles, bottom two clamps have solid holding bars. Each comes with base-spacer mounting-plate by which different thicknesses of work pieces may be handled. *Detroit Stamping Co.*

Circle No. 16

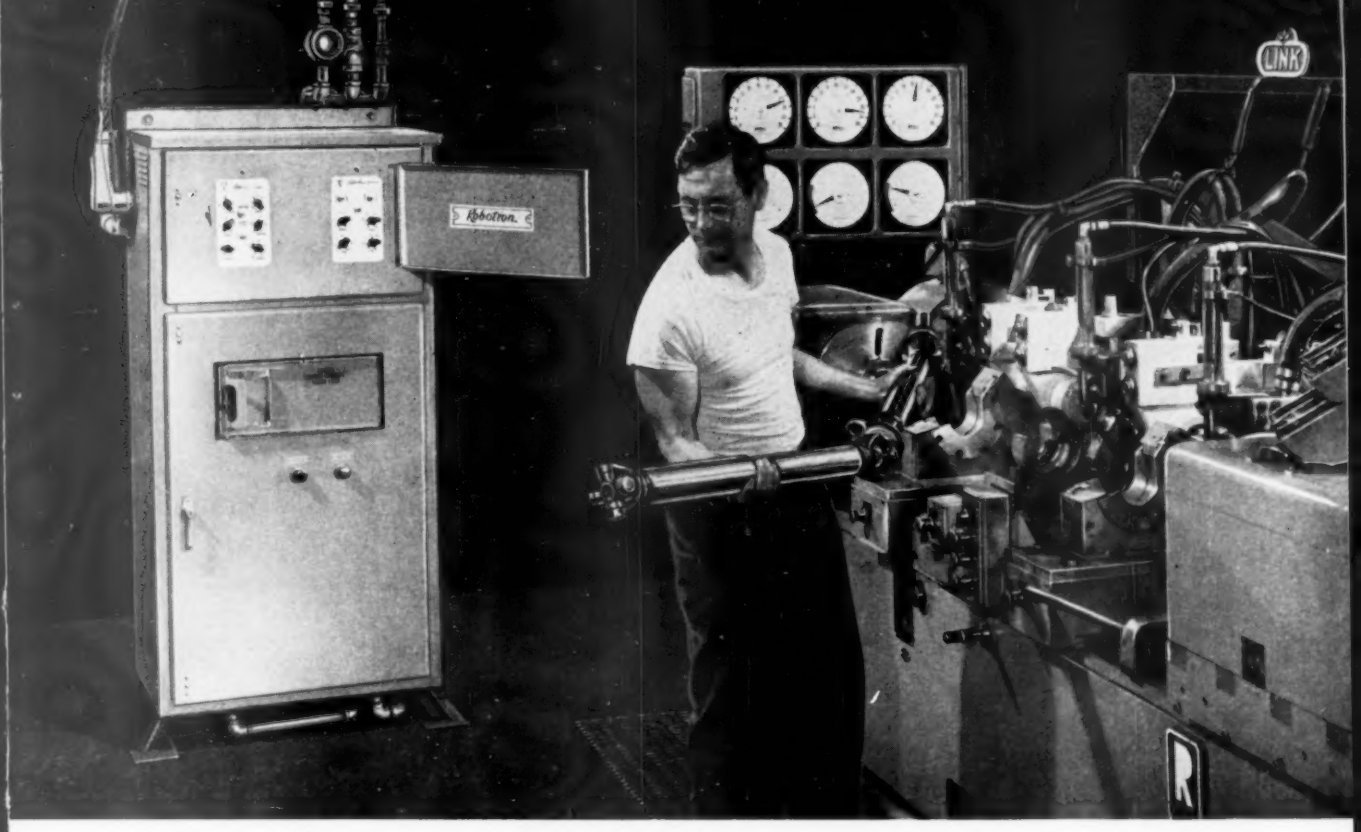


Bend testing

GUIDED bend testing machine, model GB-124, is designed to test butt welded samples according to American Welding Society and American Society of Mechanical Engineer qualification procedures. The machine can be run by an unskilled operator, manufacturer says.

Tester is 70 in. high, 18 in. by 24 in., has a 15,000 lb capacity and uses a ½ hp motor. Two hydraulic valves control pressure and directions of piston travel. *Steel City Testing Machines, Inc.*

Circle No. 17



Torque shaft assembly welded for balance and demagnetized in one operation

Robotron resistance welding controls solve costly production problem for automotive parts manufacturer

A prominent manufacturer of power steering equipment faced a costly problem involving dynamic balance in torque shaft assemblies. The company uses a specially designed machine to rotate the shaft at high speed, enabling transducers to measure the amount and location of out-of-balance and register this information on calibrated recording meters. The machine is then stopped and selected balancing weights are projection welded at indicated points along the shaft. This procedure is repeated until perfect dynamic balance is obtained. The entire operation is accomplished without removing the shaft assembly from the machine and costly handling time is eliminated.

However, in welding the balancing weights, a serious problem arose. Though fast and efficient, the resistance welding operation, with conventional controls, left an objectionable amount of residual magnetism in the shaft. This condition attracted metal filings to bearing surfaces, causing excessive wear and vibration.

The problem: how to balance the shaft and eliminate objectionable magnetism in one complete operation.

Using an imaginative new approach to the problem, Robotron engineers developed resistance welding controls employing a new technique in the application of up-down slope control. Result: *balancing weights welded and shaft demagnetized in one operation.*

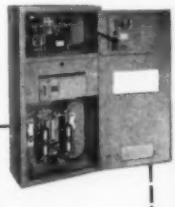
Solving tough production problems by introducing new concepts in resistance welding controls is our business. Tell us *your* problem. A letter or phone call will receive prompt attention.

CALIBRATED RECORDING METERS INDICATE AMOUNT AND LOCATION OF OUT-OF-BALANCE. BALANCING WEIGHTS ARE WELDED TO THE SHAFT WITHOUT REMOVING ASSEMBLY FROM MACHINE.

THE FINEST IN INDUSTRIAL ELECTRONICS

Robotron CORPORATION

21300 WEST EIGHT MILE, DETROIT, MICHIGAN



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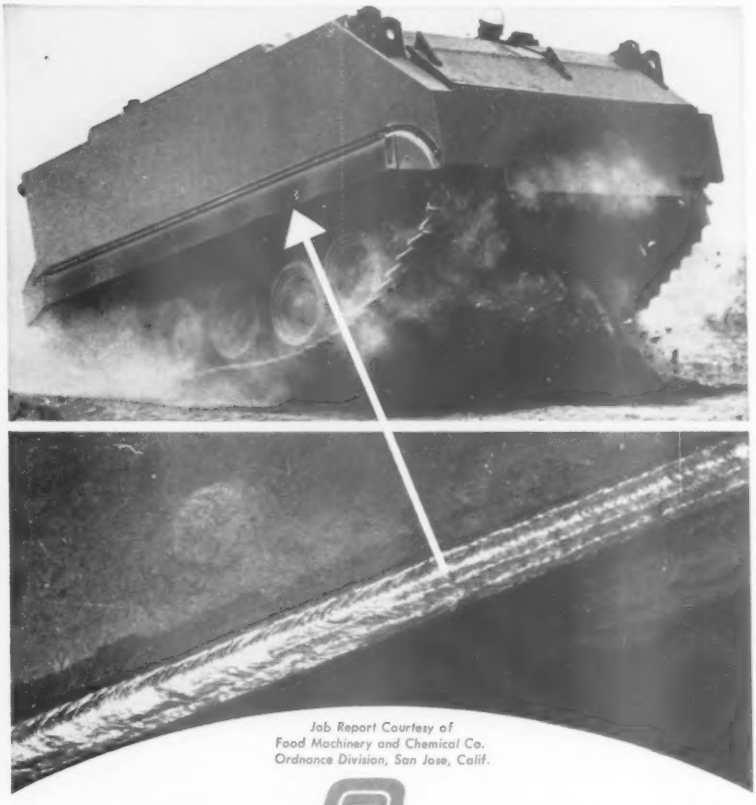
Company_____

Address_____

City_____ Zone_____ State_____

REPRESENTATIVES IN PRINCIPAL CITIES IN U. S. AND CANADA

How to produce low alloy welds to resist tons of torture



Job Report Courtesy of
Food Machinery and Chemical Co.
Ordnance Division, San Jose, Calif.

WELD WITH ARCOS

LOW ALLOY ELECTRODES

This 22½ ton armored personnel carrier proves an important point. When working with hard-to-weld low-alloy plate, and welds must be extra strong and tough in the "as welded" condition, it pays to use the highest quality weld metal available. In this case, Arcos Tensilend 100, a low hydrogen coated electrode produced weld metal that matched the physical and chemical properties of the base metal. In addition, it did the job with less nickel than the 19-9 modified electrode formerly used. There was no preheat, no postheat . . . and complete freedom from cracking. ARCOS CORPORATION, 1500 S. 50th St., Philadelphia 43, Pa.

Torch adapter

BECAUSE of the versatility of a new angular machine-torch adapter, it is replacing an entire line of Airco fixed angular heads. The cutting angle can be set without tools, and without removing the accessory from the torch. The head fits standard Airco acetylene, propane and natural-gas tips and is designed for use with the 4700 machine cutting torch. Besides vertical and horizontal cutting, the device can be used in beveling, H and I beam work, flanging and structural shape cutting. *Air Reduction Sales Co.*

Circle No. 18

Diffractometer

REDESIGNED X-ray diffractometer has extended sensitivity, accuracy and application range. The unit was developed especially for X-ray powder diffraction work. It saves time through higher intensities, automatic recording features. *Philips Electronics, Inc.*

Circle No. 19

Ceramic jigs

HEAT resistant "Sur-Braze" is a casting ceramic for use in high-temperature tooling such as brazing, welding, sintering, soldering, heat treating and heat setting jigs and fixtures. *Technion Design & Mfg. Co., Inc.*

Circle No. 20

Autrometer

DESIGN additions to a multi-indexing X-ray spectrograph have extended the range of the instrument to include 81 elements in the atomic scale, from magnesium to uranium, manufacturer says. Autrometer provides an accurate and rapid analysis of products in any critical stage of manufacture and indicates need for addition or removal of elements. It is a tool for maintaining precise quality control of incoming raw materials, processes and finished products.

X-ray tube is water-cooled and has tungsten or molybdenum target and beryllium window. Maximum rating is 2.5 kva with maximum current rating of 50 ma and maximum voltage rating of 100 kv. *Philips Electronics, Inc.*

Circle No. 21

Crimping

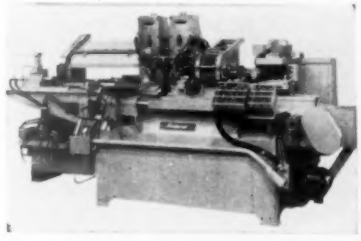
WITH the new "Delta Hemmer," parts requiring a hem die and press can be crimped. The hemmer hems multi-contoured doors, requires little floor space and makes high-bay areas available. *Delta Welder Corp.*

Circle No. 22

Cutting machines

"CONVERTIBLE" series of wire straightening and cutting machines are equipped with variable speed drives. The dual center straightener arbor on the 2CV series increases the range of the machine. *Lewis Machine Co.*

Circle No. 23

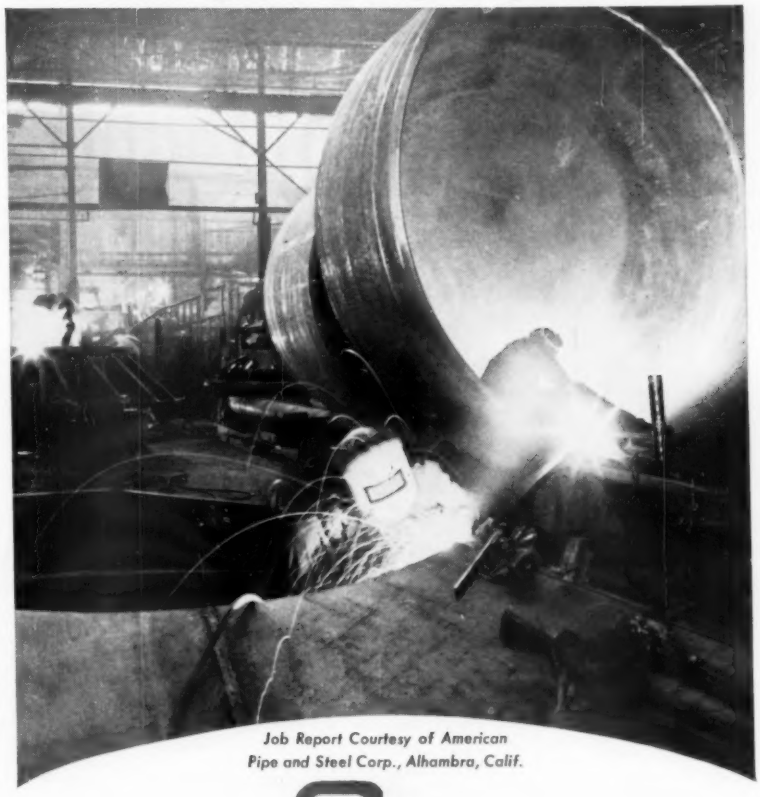


Flash welder

AUTOMATED flash welder has been designed to resistance flash weld worms to ends of automotive steering gear shafts. Parts are automatically fed from loading chutes, injected against a gage bar for correct weld position and ejected after welding. The marking device for shaft and radial positioner for worm are incorporated in the automatic sequence. The safety feature stops continuous machine operation if part loading chutes are emptied. Welder incorporates a 150-kva transformer. *Federal Machine & Welder Co.*

Circle No. 24

When heavy chrome-moly welds must pass X-Ray Inspection



Job Report Courtesy of American Pipe and Steel Corp., Alhambra, Calif.

WELD WITH ARCOS

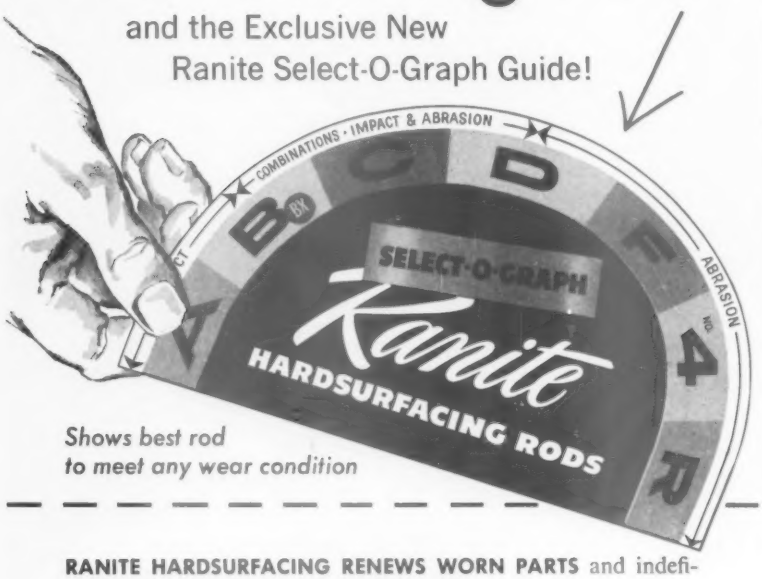
CHROME-MOLY ELECTRODES

In setting up this job—fabricating heavy alloy components of lead melting pots—new welding procedures were required to assure that all welds would pass x-ray inspection. With the help of Arcos Technical Service, both manual and submerged arc procedures were established and ARCOS Electrodes and Rods were used exclusively. The quality of Arcos weld metal consistently assures internally sound, flaw-free welds. And Arcos Technical Assistance prevented problems on what could have been a "tricky" job. ARCOS CORPORATION, 1500 S. 50th St., Philadelphia 43, Pa.

ONLY Ranite offers you
Job-Graded, Color-Coded

Hardsurfacing Rods

and the Exclusive New
Ranite Select-O-Graph Guide!



Shows best rod
to meet any wear condition

RANITE HARDSURFACING RENEWS WORN PARTS and indefinitely postpones the need for replacement.

RANITE IS "THE WELDOR'S ROD"... rated "easiest to use" by a wide margin.

JUST SEVEN GRADES MEET ALL WEAR CONDITIONS—regardless of the cause or combination of causes.

NOW EASIEST OF ALL TO SELECT—You can now pick exactly the right rod for any hardsurfacing job—thanks to the new Ranite Select-O-Graph Guide. It lets you *select automatically* the Job-Graded, Color-Coded Ranite rod to fit the conditions of *any* hardsurfacing job.

GET YOUR NEW FREE Ranite Select-O-Graph Guide—in convenient shirt-pocket size; ask your Ranite representative or write direct TODAY.

RANKIN MANUFACTURING CO.
616 S. Marengo Ave., P.O. Box No. 631, Alhambra, Calif.

Ranite
HARDSURFACING RODS

Spray powders

HARDFACING spray powders permit selection of Rockwell C hardness degree required. Parts treated with "Hi-C" withstand high temperature, abrasion or acids. The powders are nickel-base alloys and can be applied to almost all metals with melting points above 1,850 F, manufacturer states. *Western Carbide Corp.*

Circle No. 25

Suspension balancers

WELDING equipment weighing up to 10 lb can be handled with two new suspension balancers with automatic "no-drop" safety brake.

Model 5LB6 suspends loads up to 5 lb and the model 10LB6 is for equipment from 1 to 10 lb. Both balancers have full swivel upper hook with an auxiliary suspension for double safety. The balancers have a 6 ft travel range and are externally adjustable. They have nylon sheathed steel aircraft cable, rubber cable stop and heavy gage steel house. *Thor Power Tool Co.*

Circle No. 26

Programmer

SEQUENCE control "Sequentrol" establishes a number of functions that must take place in order. Can be used on welding positioner programming, test equipment, assembly operations, etc. Dials are preset to desired valves and at a signal from limit or indexing switch, each dial takes command in sequence. *Jordan Co., Inc.*

Circle No. 27

Holding device

MAGNETIC base of a new drill press can be used as a holding device while welding steel plates. Direct magnetic pull is 3,500 lb. Magnetic energy is not reduced during welding since the press is designed for continuous operation and will not overheat, manufacturer says. A safety grip trigger switch controls magnetic contact. *Black & Decker Mfg. Co.*

Circle No. 28

Control valve

FLOW control valve is pressure compensated, corrects for flow variations because of fluid temperature changes and replaces 12 models in the 5 to 1,000 cim flow range, manufacturer says. *Vickers Inc.*

Circle No. 29

Cable support

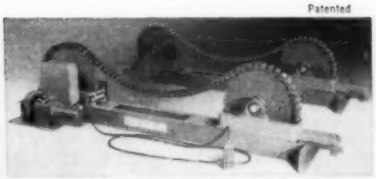
FORMED steel clamp eliminates welding cable strand breakage, manufacturer says. This cable support anchors in the electrode holder connection socket and extends back to encircle and grip the rubber jacket of the cable behind the bare strands. Bridging effect of the support, from the holder body to the jacket of the cable, stops the flexing of the bare strands behind the holder connection and stops strand breakage at this point. *Tweco Products, Inc.*

Circle No. 30

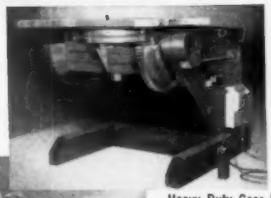
Aronson

Offers You Over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact Requirements

Patented



Aronson TracTred (T. M. Reg.) Turning Rolls for thin-walled heavy cylindrical work to 27 tons capacity. Zero to 100 IPM turning speed and Built-In Grounding.

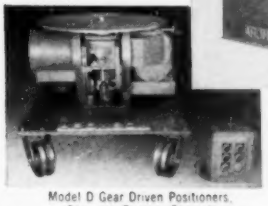


Heavy Duty Precision Built Rubber and Steel Tired Turning and Pipe Rolls, 100% overload protected. Capacities to 300 Tons.

Heavy Duty Gear Driven Positioners, with Magnetic Braking, Mercury Grounding, and Optional Speeds. Capacities to 120,000 lbs.

Heavy Duty Floor Turntables with precision speed control and Magnetic Braking, used for welding, burning, X-raying, etc. Capacities to 120,000 lbs., various heights and speeds.

Fully Automatic Gear Driven Positioners, featuring Geared Elevation, 135° Tilting and Variable or Constant Speed Rotation. Capacities to 120,000 lbs.

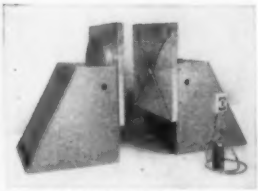


Model D Gear Driven Positioners. Compact, Precise, Rugged. Capacities to 1000 lbs.

Bench Turntable Automatic Positioners with Mercury Grounding Capacities to 500 lbs.

Patented

Aronson Universal Balance Positioners (T. M. Reg.) position your weldments effectively, instantly for downhand welding. Capacities to 2000 lbs.



Rugged Head and Tail Stock for positioning bulky weldments between centers. Table Backup for Zero Deflection, Magnetic Braking. Capacities to 160,000 lbs.

Aronson Twinner Permanent Magnetic Clamps, six models with thousands of uses in welding set-up work. Write for bulletin.

POSITIONEERING with Aronson

POSITIONERS

UNIVERSAL BALANCE® POSITIONERS
BENCH TURNTABLE POSITIONERS
GEAR DRIVEN POSITIONERS
HEADSTOCK-TAILSTOCK POSITIONERS
TRACTRED® TURNING ROLLS
RUBBER-TIRED TURNING ROLLS
RAIL CAR POSITIONERS • TURNTABLES
FULLY AUTOMATIC POSITIONERS
MAGNETIC WELDING CLAMPS

ARONSON offers you over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact requirements

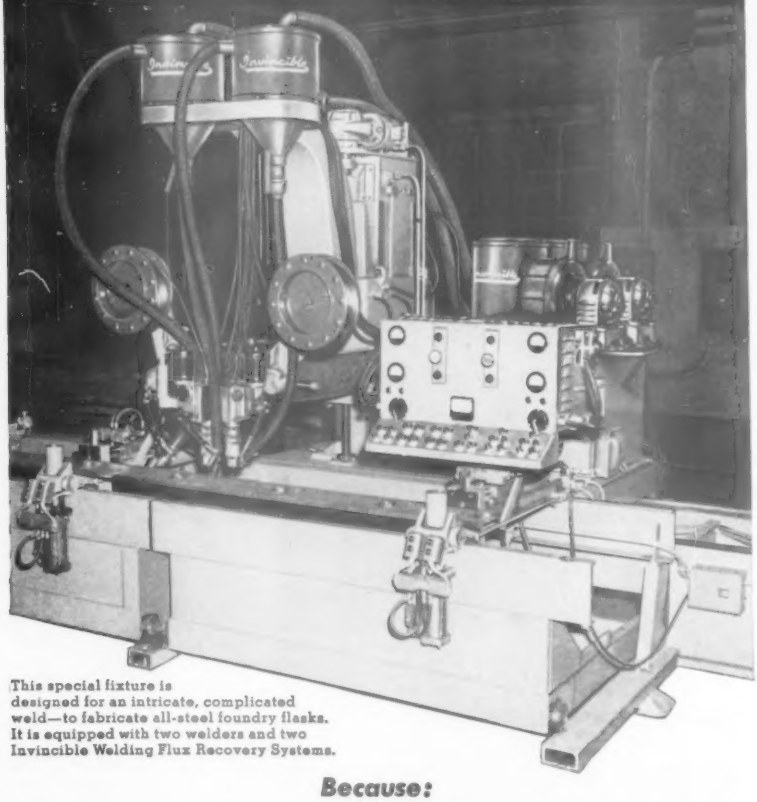
Write for detailed engineering data

Quality POSITIONERS by Aronson MACHINE COMPANY
ARCADE, NEW YORK

Welding Fixture and Positioner Manufacturers Specify . . .

INVINCIBLE

WELDING FLUX RECOVERY SYSTEMS



This special fixture is designed for an intricate, complicated weld—to fabricate all-steel foundry flasks. It is equipped with two welders and two Invincible Welding Flux Recovery Systems.

Because:

- INVINCIBLES recover *all* unfused flux on submerged arc welding jobs, remove powder and return slag-free, dust-free flux to the welder in a *continuous* flow. Savings in reclaimed flux *alone* repay their cost in a few months, or even weeks. And they save costly man-hours over manual methods, speed production, minimize costly rejects by eliminating flux flour.
- INVINCIBLES are available in 14 standard automatic and manual models from 1½ to 7½ horsepower *plus* special machines and combinations. All feature compactness, flexibility and rugged construction.
- INVINCIBLE's resident engineers in all principal cities will assist you in achieving maximum savings from submerged arc welding operations.

SEND FOR FOLDER on Invincible Flux Recovery Systems

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

Welder

FOR inert-gas and metallic-arc processes, a new a-c/d-c welder features a new arc starting control, magnetic amplifier circuit, transformer and three extra-wide current ranges. It also includes a flick-switch changeover from a-c to d-c straight or reverse polarity, a control circuit which permits sealed semi-metallic rectifiers, high frequency for continuous use or starting only, primary contactor and control transformer and power factor correction. *Miller Electric Mfg. Co., Inc.*

Circle No. 31

Electrode

IRON powder electrode for E-6010-type requirements uses the free arc or drag technique. The electrode provides a shallow rippled, smooth weld deposit in all positions, maker claims. The "Rocket 10-IP" is suitable for high pressure mild steel piping, pipe lines, structural steel work, shipbuilding and areas where out-of-position welding is done. *Hobart Bros. Co.*

Circle No. 32

Steel calculator

DESIGNED for the steel industry, a new steel weight finder determines the weight of over 1,000 steel products including steel angles, beams, channels, flats, rounds, squares, hexagons and strip. Weights of steel sheets, smooth plate, floor plate are also given. The calculator saves time for anyone using steel. All answers are given as shown in standard weight tables. Price is $2.50. *Alcott Calculator Co.*

Circle No. 33

Detergent

GERMICIDAL detergent cleans and sterilizes personal equipment such as goggles, respirators, face shields and helmets. Sold in powdered form in cartons of 25 one-oz packages. Each package dilutes in one gallon of water. Wall bracket dispenser keeps detergent dry. *American Optical Co.*

Circle No. 34

Safety goggle

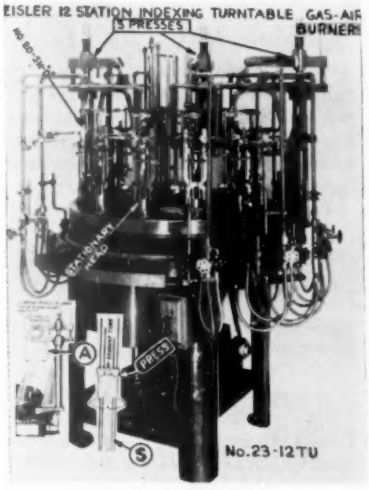
"SPECTACLE-type" frame on safety goggle fits over all prescription glasses. Visor gives over-eyes protection, full cup side shields for side and under-eye protection and a featherlight frame with adjustable metal retrax temples. Lenses are shatterproof methacrylate. Lenses available in gold or light, medium or dark green. *Watchemoket Optical Co., Inc.*

Circle No. 35

Cutting machine

VERSATILE roll-a-round dry abrasive cut-machining unit is available in two stock sizes: 6⅜ in. OD hollow sections and 12⅝ in. OD hollow section. Electric power is controlled through drum-type reversing switch and variable drive system permits selection of speed of rotation of cutting head. *Wallace Supplies Mfg. Co.*

Circle No. 36



Stem machine

A TIPLESS 12-head stem machine makes stems for the radio tube and incandescent lamp industry. On larger tubes a number of heats and more press positions are supplied to get a good press. The machine has three press positions, each individually adjusted permitting large stems to be pressed. The machine requires ⅓-hp motor and occupies 3½ by 5 ft of floor space. *Eisler Engineering Co., Inc.*

Circle No. 37

Vulcanized, permanent cable splices...
WITHOUT POWER LOSS
IN 5 MINUTES
IN YOUR OWN PLANT OR IN THE FIELD.
cam-lok
New Portable Kit . . . includes crimping press, cable cutter and vulcanizing mold.

New CAM-LOK portable Cable Splicing Kit produces vulcanized, neoprene insulated cable splices anywhere in just 5 minutes . . . makes them waterproof, shockproof.

Simply strip back insulation on cables . . . insert bare ends in copper tube supplied . . . crimp . . . place inner sleeve over crimp . . . vulcanize outer sleeve to cable jackets. No tools or experience needed . . . no production delays.

- Insulating sleeves are vulcanized to cable . . . can't pull away . . . prevents moisture from entering and damaging cable.
- Conductivity of splice is as good as the cable itself. Cables are crimped under great pressure into a pure copper crimping tube.
- Completed splice is tapered and only slightly larger than cable, so cable won't be caught on obstructions when dragged.
- Economical . . . because of low cost of components . . . allows you to splice as little as two, 2′ sections together, which might otherwise be wasted.
- Splice is flexible, because inner sleeve eliminates voids or weak spots in the insulation.
- Finished insulation of splice will withstand 2,500 volts without any leakage.

Bulletin No. 243 contains full information on this new Kit and Cable Splice. Write today for your copy.

CAM-LOK Division
Empire Products, Inc.
P. O. Box N-98, Cincinnati 36, Ohio

Convenient-Economical-Safe

HI-AMP®

World Leader in Arc Welding Supplies

Electrode Holders to fit every manual arc welding requirement from the smallest rod to the heavy iron coated electrodes. Bright Yellow Glass Fibre handles, high heat resisting Insulators, Interchangeable parts are but a few of HI-AMPS outstanding qualities. Ground Clamps built for excessive abuse with strong grip to give perfect contact. Cable connectors built for heavy duty and ease of connection. A simple twist of the wrist gives locked cable connection.

You can't go wrong with HI-AMP

LENCO, Inc. JACKSON, MO.

Increase Service Life of Tractors!

Reclaim WORN TRACTOR PARTS with MANGANAL

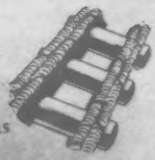
11 ¾-13½% MANGANESE-NICKEL STEEL

APPLICATOR BARS & WELDING ELECTRODES

- Work harden to 550 Brinell
- Tensile strength up to 150,000 psi
- Outlast new parts

SPROCKETS

BLADES



RAILS

ROLLERS

Write for How-to-do-it Bulletin and name of nearest distributor

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

SOLE PRODUCERS

STULZ-SICKLES CO.

PORT AVENUE at JULIA ST. ELIZABETH, NEW JERSEY

Eyeshield

ALL-plastic "spec" type eyeshield comes in large and small sizes, and in bronze or slate blue colors. Side-shields match the lens color, either clear or green. All models have a one-piece optical plastic lens which is easily removed. Non-flammable and non-sparking. *United States Safety Service Co.*

Circle No. 38

Regulator

INDUSTRIAL regulators now have a new type of pressure-molded, multi-seat block with seating material locked in place by the fly-cut ring. The seat blocks are machined before the seating material is pressure molded. Faces of the seat block or seating material need not be machined after pressure molding. *Modern Engineering Co.*

Circle No. 39

Spooled wire

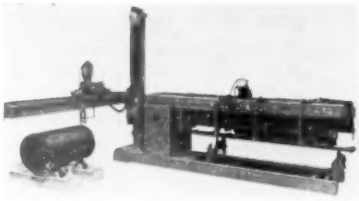
SPOOLED wire form of electrode for joining and overlay with Mig welding is a modified wire recommended for joining the higher strength, harder aluminum bronzes. *Ampco Metal, Inc.*

Circle No. 40

Cable splicer

Two minutes is all it takes to splice welding cable with its new "Ball-point" cable splicer, manufacturer claims. The splicer, No. BP-230, is made from a specially designed extrusion of high conductivity aluminum. Two 9/16-in. diameter cadmium plated steel ball-point screws are at right angles to the cable sockets. The sockets accept No. 2 through No. 3/0 aluminum or copper cable. A 7/32 in. hex drive wrench tightens the screws. The burnishing action of the ball-point screw removes oxides from cable strands. A heavy wall fibre sleeve covers the splice for maximum safety. *Tweco Products Co.*

Circle No. 41



Welding head

DUAL use of automatic welding equipment for welding metal cylinders and tanks is possible with automatic welding head, mounted on carriage so longitudinal seams can be welded while cylinder is clamped in a copper back-up, air clamped seaming fixture.

Manipulating fixture is rotated to position welding head over the cylinders mounted on variable speed turning rolls for welding circumferential welds. Equipment is available to weld any size or range of cylinders. *Pandjiris Weldment Co.*

Circle No. 42

Solvent

INDUSTRIAL solvent for use with ultrasonic cleaning equipment offers electrical stability, rapid drying, safety and low unit cost, manufacturer says. It can remove contaminants without affecting plastics, decals, numbers, magnet wire, insulating varnishes, etc. The non-ionic, non-hydroscopic liquid is stable and safe for use with electronic cleaning equipment.

In 10 seconds cleans out rosin fluxes, oils, greases and dirt; another five minutes in ultra-sonic dryer and parts are ready for packing. *London Chemical Co., Inc.*

Circle No. 43

Flux

WELDING flux suitable for general brazing, cast-iron welding and cast-iron brazing with oxyacetylene is non-fuming and non-toxic, manufacturer says. The flux, No. 2, can depress filler metal bubbling and fuming and dissolve and remove oxides. *Ampco Metal, Inc.*

Circle No. 44

Optical marking

HORIZONTAL toolroom measurements are possible with a movable work table, and flat staging table is for production-line optical gaging. They are available with new Kodak Contour Projector Model 14-6.

With the flat, 13 by 19⅝-in. staging table, the projector meets requirements of "on-the-line" inspection work. For toolroom measurement work the movable work table makes possible measurement to 0.0002 in. *Eastman Kodak Co.*

Circle No. 45

GB 88 FLUX.. *available in 3 oz., ½ lb., 1 lb., 5 lb. jars and 25 lb. drums to suit your needs*

Use GB 88 Flux, the flux of proven dependability and note the improvement in the quality of your Silver Brazing. GB 88 is fully active to 1650°F.

Low glare and low fuming characteristics insure operator comfort and quality results. It is stable in use as well as in storage and was developed for Silver Brazing of STEEL, BRASS, COPPER, STAINLESS STEEL, MONEL, NICKEL, INCONEL, CHROME ALLOYS, SILVER and GOLD.

For best results team up GB 88 Flux with GB Silver Brazing Alloy in the form or size you require: random coils (all diameters), strip, straight lengths, pre-formed rings and special shapes. Prompt service on all inquiries.

1857 – 1957 90th ANNIVERSARY

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DETROIT • OAKLAND

Mail Coupon for your FREE copy of the GB Data Book— complete information on low temperature Silver Brazing

PLEASE SEND GB Data Book without obligation.

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GOOD WELDERS DO BETTER WITH

ALL-STATE

ALLOYS AND FLUXES

They Save On:

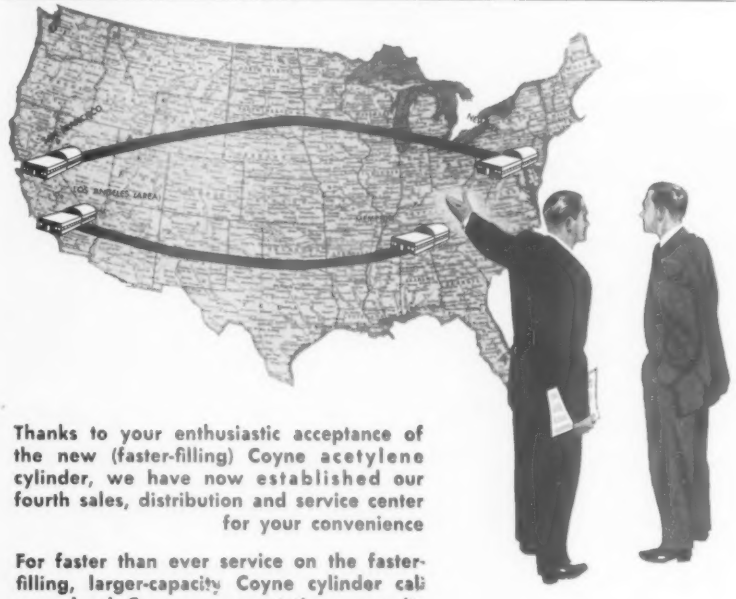
- Preparation
- Dismantling
- Reassembly
- Cleanup
- Heat
- Time

Seldom cost as much as 1% of savings made!

ALLOYS All-State FLUXES

Look for this trade-mark at your Welding Supply Distributor's. All metals. All methods. All-State is your assurance of these advantages when you buy. Ask for new Instruction Book on 62 alloys and fluxes.

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

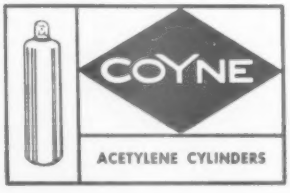


Thanks to your enthusiastic acceptance of the new (faster-filling) Coyne acetylene cylinder, we have now established our fourth sales, distribution and service center for your convenience

For faster than ever service on the faster-filling, larger-capacity Coyne cylinder call your local Coyne representative, or write direct to the location nearest you

Coyne Cylinder Company

155 W. BODLEY AVE., MEMPHIS, TENNESSEE
200 PAUL AVE., SAN FRANCISCO, CALIFORNIA
511 S. FULLERTON ROAD, LA HABRA, CALIFORNIA
24 COMMERCE ST., NEWARK, NEW JERSEY



Oxygen indicator

TWENTY times more sensitive than any other oxygen indicator on the U.S. market, says the manufacturer about his new product. Besides laboratory work, the device has application in atomic-energy work, metals treating and the manufacture of chemicals, electronic equipment, bottled industrial gases, etc. *Baker and Co.*

Circle No. 46

Dust collector

EXTRA storage capacity dust collector, "Dustkop model 520-D", is 10 in. higher than standard model 520, but has identical air-handling characteristics and base dimensions with a dust storage bin that is over twice as large. Base is 18 in. by 23 in., height is 34 in. *Aget Mfg. Co.*

Circle No. 47

Plastic repair

REPAIR work and patching can be done with a new plastic substance which has high bonding strength on metals and soft or hard woods. It can be applied in any thickness and hardens like steel, manufacturer states. "Marine-Tex" is non-toxic and can be used to make machine fixtures, precision forming dies and matrix for punch dies. It will salvage metal parts, rebuild damaged machinery and fill holes drilled incorrectly in dies, molds and castings. It seals cracks in storage tanks, pipes, etc. When hardened, Marine-Tex has a tensile strength of about 10,000 psi. One-lb trial kit costs $4.50. *Travaco Laboratories.*

Circle No. 48

Weld positioner

Bench-type welding positioners are available in three models with torque ratings of 25, 100 and 250 in. lb. They can be obtained with hollow spindle, free wheeling, power tilt, precision speed control, and electric tachometers. The positioners have hp ratings of 1/75, 1/10 and 1/6. *Stahl Equipment Co.*

Circle No. 49

NEWS . . . . . *from page 6*

tour are: Dr. Leslie L. Seigle, fundamental metallurgy section, Sylvania Electric Co.; James H. Bechtold, physical metallurgy research laboratory, Westinghouse Electric Co. and T. W. Lipper, director of marketing, Titanium Metals Corp. of America.

Tube Turns spreads out

The welding fittings and custom forgings departments of Tube Turns will be expanded by a construction program adding 40% to the total manufacturing area. Three buildings adjacent to the Louisville, Ky., plant, will be connected to the main building. The expansion will provide more plant facilities for products now in the design and development stage also.

Construction will be finished in 10 months, says John G. Seiler, Tube Turns president. The firm, which produces welding fittings, purchased the 13-acre site in July, 1956. Besides the three buildings to be connected, a fourth building on the site gives extra floor space for expansion. Tube Turns recently purchased an adjacent 2.6-acre plot for future construction.

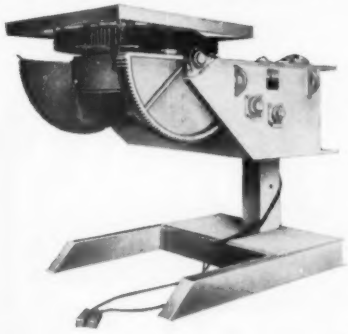
Lithium is key to aircraft alloy

A new lithium alloy will maintain high strength up to 400 F. This pushes the thermal barrier, a threat to aluminum applications in supersonic aircraft, ahead by more than 100 F, reports the Aluminum Co. of America.

Johnson-Williams acquire Heiland gas indicator

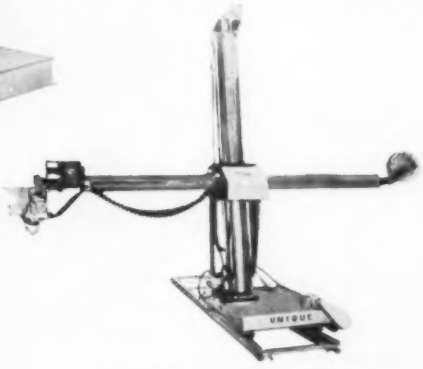
Johnson-Williams, Inc., of Palo Alto, Calif., have taken over sales and servicing of the Heiland gas indicator from the Heiland Div. of Minneapolis Honeywell, Denver, Colo.

IF YOU NEED THIS EQUIPMENT . . .
YOU HAVE ALREADY PAID FOR IT!

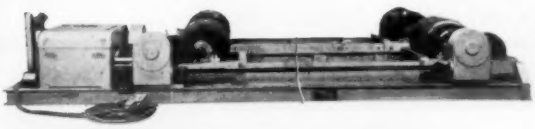


PRECISION WELDING POSITIONERS

Model UPC-Series
Featuring: **NO BACKLASH** when new or old. Adjustable pinions eliminate this condition.
Capacities: From 500 lbs. to 60,000 lbs.



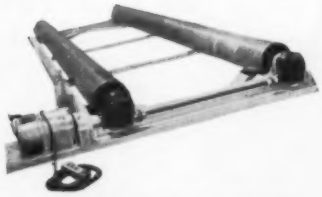
PRECISION WELDING HEAD MANIPULATORS



Model UM-Series
Featuring: Boom leveling & Track lateral adjustments.
Capacities: From 6 ft. to 16 ft. on Booms. From 6 ft. to 16 ft. on Masts. Larger sizes available.

POWERED PORTABLE TURNING ROLLS & FRAME-BASE ROLLS

Model UTP-Series
Featuring: Perfect smooth rotation.
Capacities: From 2,000 lbs. to 500,000 lbs.



POWERED & IDLER FIT-UP ROLLS

Model UFR-Series
Featuring: 20 ft. length adjustable rollers for perfect tack-up or finished "butt" alignment.
Capacities: From 10,000 lbs. and up.

POWERED TILTING ROLLS

Model UTRP-Series
Featuring: Tilting to 35 degrees in either direction.
Easy pull-cuts for variable lengths.
Thrust balls for closed end vessels.
Radial bearings for open end vessels.
Capacities: From 5,000 lbs. to 20,000 lbs.

UNIQUE EQUIPMENT, INC.
122 Sumpter St. Brooklyn 33, N. Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

GENERAL OFFICES: 150 East 42ND STREET, NEW YORK 17, N. Y.

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

LAY OUT PIPE JOINTS *in minutes!*

SAVE TIME AND MONEY!

A SMOOTH SWING of the Contour Marker's soapstone point and you're ready to cut! It's easy and *absolutely accurate* because there is an angle dial calibrated in both degrees and pitch. Any of the pipe joint angles shown can be marked off in minutes. And you save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are completely eliminated. Two sizes are available complete with adapter for marking structural steel. Standard, for pipes from 1½" to 18" dia.; Jumbo, for pipes from 16" to 48" dia. Instruction book included. Belt case available. Write for information

CONTOUR MARKER CORPORATION OF CALIFORNIA

1843 E. Compton Blvd., Compton, California • NEwmark 1-9474

THE CONTOUR MARKER

All-welded water tank holds 1,000,000 gallons

A 1 million-gallon all-welded steel water storage tank was recently raised by the Chicago Bridge & Iron Co. for the Southeastern Oakland County Water Authority at Berkley, Michigan. The 10-ft high tank; called a "Hortonspheroidal," is 87½ ft in diameter with a range of 25 ft between the low and high water level.

The spheroid is supported 76 ft above the ground by twelve 48-in. diameter cylindrical columns on a 40 ft radius. The fluted design of the central column makes it capable of withstanding a much heavier load without additional reinforcement.

Louis Howson named ASCE president

On Oct. 16, the American Society of Civil Engineers installed Louis R. Howson as president for one year. The Chicagoan succeeds Mason G. Lockwood, Houston, Tex. At the same time, two vice-presidents, Waldo G. Bowman, New York and Samuel B. Morris, Los Angeles, and six directors took office at the annual society meeting in New York City.

Black elected chairman of Canadian CGA

New chairman of the Canadian section, Compressed Gas Association, Inc., is David W. Black. Other officers elected at the section's annual meeting held recently were: Keith W. Shaw, 1st vice chairman and W. A. Taylor, 2nd vice chairman.

Maintenance meet includes welding

Welding is one of the subjects to be discussed at the Ninth Plant Maintenance & Engineering Conference scheduled for the International Amphitheatre, Chicago, Jan. 27 to 30.

Two supply stores open in California

Absco Inc., Los Angeles, recently opened two new welding supply stores in California. An El Monte store has been moved about half a block and enlarged. The second store, in San Francisco, extends the firm's state coverage. According to firm president G. Milton Sims, the new San Francisco store "will allow us to serve California effectively in the welding supply field."

INTERIOR view of Absco, Inc.'s newest welding supply store at El Monte, Calif. (See story at left.)

Nuclear Systems gets Chicago office

Nuclear Systems, a division of the Budd Co., recently opened a new district office at 5935 S. Pulaski Road in Chicago.

Oxygen converter gains U.S. popularity

After 100 years of steelmaking by the pneumatic process, the basic oxygen converter is beginning to be used in this country. The new process substitutes high-purity oxygen for air and blows it at ultrasonic speeds onto the top of the molten metal bath. The pneumatic process blows either natural air, oxygen enriched air, oxygen and steam or oxygen and carbon dioxide mixtures over molten iron to get steel.

The first U.S. oxygen process plant started in 1954. A practical, low-cost method of steelmaking, the new process turns out low-carbon steels.

Incidentally, the American Iron and Steel Industry reports that the center of steel making capacity is now at Westminster, O.

Steel society offers repair welding manual

"Recommended practice for repair welding and fabrication welding of steel castings," is a new manual published by the Steel Founders' Society of America. The manual includes development in welding procedure since 1951. Copies are available at 50 cents each from the Steel Founders' Society of America, 606 Terminal Tower Building, Cleveland 13, O.

Vogel Tool and Die extends operations

A fully equipped pipe and tubing fabricating department has been added to Vogel Tool and Die Corp., Melrose Park, Ill. The firm does cutting, notching, piercing, flaring, slotting, bending, etc.

Square D completes Atlanta plant

Square D Co. recently finished an equipment assembly plant in Atlanta, Ga. The firm plans to end its two-year capital expansion program this December after building manufacturing plants in Milwaukee and Lexington, Ky.

NEW
ARO Model 410
Air operated gun with "Ski-lift" type gyro suspension

ARO
Portable
SPOT WELDERS

Visit us at
BOOTH 1692
ASM SHOW — CHICAGO
NOV. 4-8

- No power loss. Transformer built-in
- Handy, maneuverable—no heavy, unwieldly cables
- Usually costs about half as much as gun-plus-transformer
- Works on existing power lines
- Automatic timing

Illustrated Literature on Request

ARO SPOT WELDERS
DIVISION OF
GUTHERY MACHINE TOOL CORPORATION
38-31 CRESCENT STREET LONG ISLAND CITY 1, NEW YORK
Dealer Inquiries Invited

"WE CUT REWORKS 94% With Dry Rod Electrode Oven!"

Type 300 Dry-Rod Oven

WHEN 1 out of 3 welded hydraulic fittings were rejected by a leading Milwaukee machinery plant*, engineers blamed *moist electrodes.* Installing a low-cost Dry-Rod Electrode Oven to store all unpackaged low-hydrogen rods, this company got immediate improvement . . . faster, better welds . . . few rejects. Reworks were cut from 30 pieces to less than 2 per hundred.

Type 10 Portable Dry-Rod

DRY-ROD Ovens insure against defective welds caused by moisture, protect low-hydrogen, austenitic, special alloy electrodes, and iron powder contact rods. Completely wired, ready to use. 3 sizes available, for all industrial needs.

See Your Welding Supply Dealer

*Name upon request

Dry®Rod

Division of

PHOENIX PRODUCTS CO.

X-DR-23 4716 N. 27th St.—Milwaukee 9, Wis.

You'll find Ruemelin Fume Collectors ideal for stopping noxious welding fumes *at their source.* Counter-balanced inlet hood stays in working area, automatically. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Thousands in everyday service. Write for Fume Collector Bulletin No. 37E.

(Left) "Illustrating the 15 ft. reach collector. Handles large or small work. Units available with 9 ft., 15 ft., 17 ft. and 20 ft. reach."

RUEMELIN MFG. CO.

MFRS. & ENGRS. • SAND BLAST & DUST COLLECTING EQUIPMENT

3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

New facilities for International Rectifier

International Rectifiers' 10th anniversary celebration included moving into a new office building in El Segundo, Calif.

The administration building (above) is built around a central patio, features radiant heating in the winter, air conditioning for summer. Of steel, red brick, glass and redwood, it houses the business offices. About 10,000 sq ft are used to produce silicon and germanium power rectifier junctions.

AT the speakers' table at a recent AWS regional conference were: Arthur Schueler, Precision Welder & Flexopress Corp.; T. B. Jefferson, *WE* editor and publisher; C. P. Sander, AWS national president; Harvey Miller, Boston section chairman; Fred L. Plummer, AWS National secretary.

WE publisher addresses AWS

Ted Jefferson, editor and publisher of *Welding Engineer*, discussed "The future of welding" at the New England Regional Conference on Welding held recently in Boston. The meeting was sponsored by District One of the American Welding Society.

The day-long program was divided into six technical sessions, conducted by experts in welding and brazing. They included metallic arc welding, resistance welding, high temperature brazing, inert gas welding. Speakers were: J. E. Dato, Linde Co.; A. Schueler, Precision Welder and Flexopress Corp.; R. L. Peaslee, Wall Colmonoy Corp.; E. W. Jamison, General Electric Co.; H. Thielsch, Grinnell, Co.; W. A. Wilson, U.S. Army Ballistic Missile Agency. Chairman of the program was Allan Rosenberg of the Boston section.

AWS national president C. P. Sander and Fred L. Plummer, national secretary, attended the meeting.

FIRST welding class for 4-H boys in Maine was made possible with supervision and equipment supplied by Maine Oxy-Acetylene Supply Co. of Auburn.

4-H group studies welding

A group of boys in Maine have recently completed a 9-week course in arc welding, weld and cut in order to repair farm equipment. The group is believed to be the first of its kind in Maine to complete such a course.

Maine Oxy-Acetylene Supply Co., Auburn, provided the instructors, James Albiston and Herbert Howard, and made its plant equipment available to the boys. At the end of the session, the boys could weld with gas and electric equipment using acetylene, oxygen and electricity.

Hooker, Foote explore high energy fuels

Foote Mineral Co., Philadelphia, is working with Hooker Electro-chemical Co., Niagara Falls, N.Y., to explore possibilities to develop, produce and sell components of high energy fuels. Currently their interest centers on lithium perchlorate and ammonium perchlorate, materials which act as oxidizers in fuels for rockets and missiles.

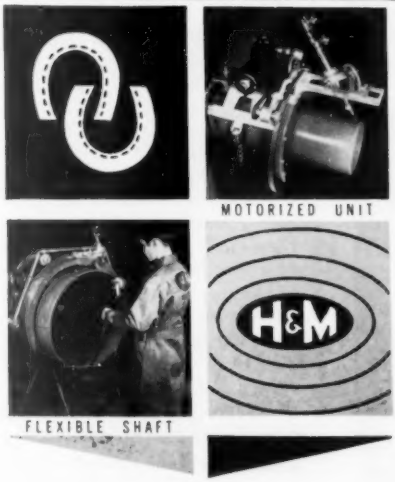
Metallurgy, ceramic studies available

Atomic Energy Commission studies, "Tungsten-arc welding of Ames thorium and thorium alloys," (35 cents) and "Resistance-welding methods for end capping PWR uranium oxide fuel rods," (30 cents) are available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Acoustica Associates get larger quarters

Acoustica Associates, Inc., recently moved from Glenwood Landing, N.Y., to 26 Windsor Ave., Mineola, N.Y. The firm designs and manufactures ultrasonic soldering guns, cleaning units, etc.

2 MORE CHAMPIONS . . FROM THE SAME STABLE



H & M offers *complete visibility* in pipe cutting and beveling. H & M's *Flexible Shaft* and the H & M *Motorized Unit* both allow the operator to stand *in front* of the pipe being beveled and observe the bevel through the complete 360 degrees.

The FLEXIBLE SHAFT attaches quickly and easily to any H & M machine, and allows the operator a full view of the circumference of any size pipe, while regulating the speed of the torch.

The MOTORIZED UNIT provides complete automation of pipe cutting and beveling, and is easily and economically attached to any H & M machine. With an easily-regulated, governor-controlled motor, consistently smooth and perfect cuts and bevels are attained . . . AUTOMATICALLY.

Write today for fully illustrated details of the complete H & M line.

H&M TM Reg

PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TULSA, OKLAHOMA

LOW COST X-RAY UNIT IS HIGHLY PORTABLE

Never before has so powerful, so portable, and so versatile an X-ray unit been available at so low a price. Radical design improvements make the Baltospot 200 low in cost but high in performance.

Portable but powerful. X-ray head weighs only 85 pounds; rating is 200,000 volts.

Versatile. Baltospot 200's low inherent filtration permits top quality radiographic inspection of materials ranging from thin magnesium sheet to 3" of steel.

Rugged. X-ray unit is elastically supported within a sturdy but light metal housing. It's shockproof, weatherproof, dustproof, waterproof.

Safe, simple to operate. With the Baltospot 200's simplified controls, X-raying is easier than taking a snapshot. Automatic protection devices make it foolproof and safe. *Please write for details.*

OTHER UNITS rated 120 to 260 KV for portable and stationary inspection of material up to 4" of steel. BG 180 for 360° radiography.

BALTEAU ELECTRIC CORPORATION
New and Meadow Streets, Stamford, Connecticut

Manufacturers of DIFFERENT X-Ray Equipment for Industry and Medicine

Still Supple after 400° F.

Specify...

WELDTAN

HEAT-RESISTANT LEATHER For Your Work Gloves

WELDTAN leather gives added SAFETY! Weldtan is super-chrome tanned cowhide split leather. It remains soft and pliable even after exposure to 400° F.

WELDTAN leather is easier to work in! Weldtan has a supple softness that adjusts to every movement of the hand. After being subjected to heat, it has 22.6% less shrinkage than horse split leather.

WELDTAN leather lessens glove costs! Weldtan has 2½ times the abrasion resistance of horse split leather. You have less frequent replacement costs than with any other type of leather.

General Split Corporation
World's Largest Producer of Glove Leather Splits
730 W. Virginia St. • Milwaukee 4, Wisconsin

COMING EVENTS

NOV. 4-6: Independent Oxygen Manufacturer's Association annual winter meeting, Edgewater Beach Hotel, Chicago.

NOV. 4-8: Thirty-Ninth National Metal Exposition & Congress, concurrently with Second World Metallurgical Congress, American Society for Metals, International Amphitheatre, Chicago.

NOV. 11-12: NWSA West Central Zone Meeting, The Cosmopolitan, Denver.

NOV. 14-15: NWSA Western Zone Meeting, Riviera Hotel, Las Vegas.

DEC. 2-3: NWSA Southeastern Zone Meeting, Atlanta Biltmore, Atlanta.

DEC. 5-6: NWSA Southeastern Zone Meeting, The St. Anthony, San Antonio.

JAN. 27-30: Ninth National Plant Maintenance & Engineering Show, International Amphitheatre, Chicago.

MARCH 19-21: Fifty-eighth Annual Convention, International Acetylene Association, Bellevue Stratford Hotel, Philadelphia.

APRIL 14-17: Sixth Annual Welding Show, American Welding Society, Statler and other hotels, St. Louis.

APRIL 14-18: Sixth Spring and Thirty-ninth Annual Meeting, American Welding Society with American Society of Mechanical Engineers Conference, St. Louis.

MAY 5-8: Fourteenth Annual Convention, National Welding Supply Association, Americana Hotel, Miami Beach, Fla.

WRMA formed to set ring specifications

The Welded Ring Manufacturers' Association has been organized to fulfill the requests of code and specification-writing bodies for industry-wide acceptance of new and improved ring specifications.

WRMA member companies, which will assist in specification formulation are: American Welding & Mfg. Co.; Cleveland Welding Div., American Machine & Foundry Co.; Cooper Alloy Corp.; Dresser Mfg. Div., Dressers Industries, Inc.; Edgewater Steel Co.; King Fifth Wheel Co. and Ladish Co.

Stanford Research gets new lab

Metallurgical research has been expanded into a $500,000 laboratory at Stanford Research Institute, Menlo Park, Calif.

Distributor appointments

Linde Co., New York: Hill Equipment Co., St. Louis.

New manager of arc welding sales for Airco's eastern region is *Henry O. Westendarp*, formerly General Electric's New York district manager. Other former G-E welding staff members who have joined Airco's sales force are: *W. G. Leman* at Buffalo, *Walter Roe Jr.*, at Philadelphia, and *Richard Nowell* at Jersey City.

Peterson

Fallek

Minneapolis' Smith Welding Equipment Corp. recently appointed a new advertising manager and a new market research director. Filling the advertising post is *Robert L. Peterson*, formerly with the G. H. Tennant Co., Minneapolis. *Malcolm E. Fallek* moves into the market research slot. He was with the Business and Economics Research Dept. of Minnesota Mining & Mfg., St. Paul. Peterson will supervise all space advertising, sales promotion programs and trade show participation. Fallek will direct market research and analysis studies.

In Pittsburgh, *Charles W. Iams* has been appointed an assistant vice president, industrial engineering, of United States Steel Corp. Taking his place as assistant to general manager of steel operations is *John A. Eckel.*

William R. Kiley has been appointed applications engineer by Philips Electronics, Inc., Mount Vernon, N. Y.

Air Reduction Sales Co. has chosen *H. C. Wallace* as regional sales manager for its Southern region, succeeding *M. G. Wicker*. Wallace will headquarter in Houston, Texas. *A. W. Gilpin* succeeds Wallace as assistant to the regional sales manager and *R. Pringle* follows Gilpin in the assistant sales manager post at Houston.

More Comfort-Greater Safety

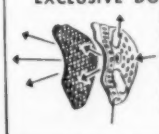
RIGID BAR No. 621

NEW

SELLSTROM

619 AND 621

JUMBO CHIPPING GOGGLES



EXCLUSIVE DOUBLE-FILTER VENTILATION MEETS ALL FEDERAL SPECIFICATIONS. Diagram (left) shows how air is double-filtered through fine brass screen for greater eye comfort and protection.

FLEXIBLE BRIDGE No. 619

These new lightweight SELLSTROM Jumbo Chipping Goggles increase eye comfort and safety in chipping and grinding work. Both styles fit easily over personal glasses. Complete with clear hardened safety lenses.

WRITE TODAY for Sellstrom Bulletin 33-C

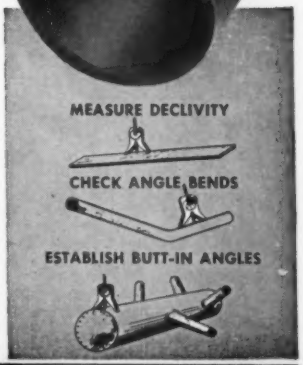
SELLSTROM MANUFACTURING CO.

226 South Hicks Road • Palatine, Illinois

DIAL SET LEVEL _____

MARK A CENTER LINE *at any angle*

DIAL SET 45° _____



TO ESTABLISH AND MARK a point at any degree of angle on shaft, pipe or tube without numerous calculations or "cut and try" methods use the Boyce Centering Head. It's a must for welders, machinists, pipe fitters and boilermakers because it is *absolutely accurate* and saves time. Small enough to fit in your pocket, it weighs only 9 ounces. Order yours today or write for information.

CONTOUR MARKER CORP.

1843 E. Compton Boulevard, Compton, California

Boyce CENTERING HEAD

For PROTECTION you NEED with the COMFORT you WANT

Flood Always
FINEST QUALITY
FAIRLY PRICED

FIBER GLASS HELMET

Strong, one-piece molded shell. Lightweight. Non-warping. Heat and moisture resistant. Easy to clean and sterilize. Comes with Flood No. 14 fiber or No. P-14 all plastic ratchet-type head gear.

FACE SHIELD

Excellent protection for spot welding, grinding, buffing, acid pouring. Fiber forehead shield. Contour headgear. Easy, window replacement without tools.

Manufacturers of Welding and Industrial Safety Equipment, including Flood's 1000-Hour Cover Lenses.
At Your Distributor or Write

FLOOD SAFETY PRODUCTS CO.
3035 West Lake Street, Chicago 12, Illinois

Lepel

HIGH FREQUENCY
Induction
HEATING UNITS

BRAZING
ANNEALING
HARDENING
SOLDERING
MELTING

LEPEL Electronic Tube GENERATORS—1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
LEPEL Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

John Fitzgerald has been promoted to manager of field sales for Alloy Rods Co. In the newly created position, Fitzgerald will assist *F. L. Blodgett*, general sales manager, to administer sales policies at branch offices and distributor sales organizations.

Fitzgerald

Sam Gurley, Jr. is vice president of sales for Olin Aluminum. He had been vice president-sales for H. K. Porter, Inc., Pittsburgh.

Walter E. Steward has filled a newly-established position as manager of production engineering for the American Welding and Mfg. Co., Warren and Niles, O. He will coordinate the firm's four main engineering divisions. Steward was with the Minneapolis-Moline Co.

At the U. S. Steel Supply Div. headquarters in Chicago, *Daniel F. Darney* has been appointed manager, stainless steel products division. *Alvin L. Krieg* is new district director of public relations in Chicago, succeeding *Paul Sullivan*, who has been assigned to Los Angeles as district director, public relations, of the Pacific Southwest.

James R. McConnell will fill the new post of manager of abrasive sales at Pangborn Corp., Hagerstown, Md. He will coordinate newest technical developments in blast cleaning materials with customer and field service.

Lindberg Industrial Corp.'s new Eastern division manager is *Lester A. Shea*. He will supervise the firm's activities from Fair Lawn, N. J. Shea has been with Lindberg since 1937.

Wheelabrator Corp. has made the following appointments: *George F. Burditt*, manager, Steel Mill Equipment Sales Div., Mishawaka, Ind.; *Joseph F. Underway*, district manager, Pittsburgh territory; *John B. Booth*, sales engineer, Los Angeles sales office; *Francis E. Noyes*, district manager, St. Louis sales territory; *Wayne L. Hungate*, sales and service engineer, St. Louis; *William A. Illsley*, district manager, Cincinnati territory; *William E. Scherrer*, sales engineer, Cincinnati.

"ANTI-BORAX"

"ROYAL"
CASE-HARDENING POWDER

- More effective than cyanide. Gives off no dangerous fumes. Simplifies the work. Economical to use.
- Makes low-grade steel perform like high-grade steel.
- Enables the weldor or blacksmith to produce a finer cutting tool with technical equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large and small low-carbon steel tools and parts.
- Write for sample and descriptive booklet.
- Manufactured by the makers of "E-Z", & "Crescent", Welding Compounds and "Anti-Borax" Oxy-Acetylene Welding and Brazing Fluxes.

ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE 9, INDIANA

SHOOT-A-LITE
SAFETY GAS LITER

The Practical Lighter for welding and cutting torches

SAFE! SURE! STRONG!

Ask your jobber or write us.

SHOOT-A-LITE CORPORATION
110 Washington St. • Dept. WE
New York 6, N. Y.

Dr. I. A. Oehler has been elected executive vice president and a member of the board of directors of the American Welding and Mfg. Co., Warren and Niles, Ohio. He has been with the firm for 15 years.

A pioneer in the development of hydraulic power for industry, *William C. Denison* has been elected a vice president of American Brake Shoe Co. He is also president of the firm's Denison Engineering Div.

J. O. Cavanagh has been elected vice president in charge of research at Alloy Rods Co. He began his career in welding research in 1936 at Hollup Div. of National Cylinder Gas Co. New field representative in Houston is *A. A. Averbeck*. He was formerly with the Welding Div. of General Electric.

Fibre-Metal Products Co. has chosen *Gilbert Doyle* its direct factory representative for Eastern Canada. He was formerly sales manager of Levitt Safety Ltd. He will be responsible for welding and safety distributor sales in Eastern Canada.

Edward G. Belden has joined Robert H. Newton Co., Cleveland, as sales engineer.

New vice president, research and development, at Linde Co. is *Dr. L. I. Dana*. *David Swan* has been appointed director of research at the firm.

Vincent Reed is the new Youngstown District sales representative for Desco, Inc., of Cleveland, Ohio. He was formerly welding engineer for Firestone Steel Products Co., Akron, Ohio.

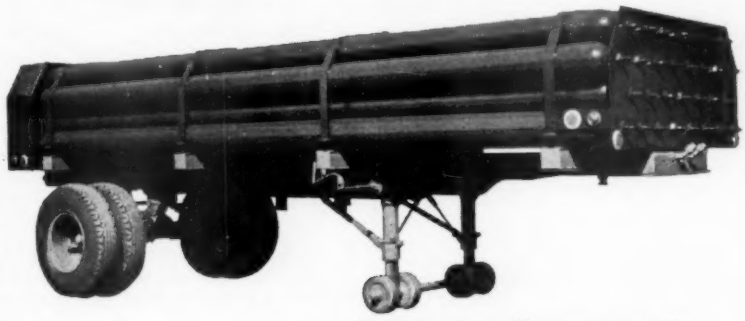
Edward M. Grady has been named sales manager of mill products, Western Brass Mills Div. of Olin Mathieson Chemical Corp., at E. Alton, Ill. *William L. Ashlock* has been appointed to the new position of manager of national accounts of the Brass Mills division. He will continue as regional manager for the Detroit area.

Thomas L. Kelley has been selected as nuclear sales manager for Tracerlab, Inc., Waltham, Mass. He was in charge of the Instrument division.

REDUCE CYLINDER HANDLING up to 50%

with INDEPENDENT *Gas Supply TRAILERS*

TRANSPORTING — Argon — Carbon Dioxide — Helium — Nitrogen — Oxygen — Boron Trifluroide — Hydrogen — Ethylene. Trailer capacities from 187,000 cu. in. to 750,000 cu. in. water capacity. Trailer tubes ICC3A-2400 Specifications with 2400 PSIG Working Pressure.



Sizes and weights to meet all State requirements.

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FOR ALL HEAT-DEPENDENT OPERATIONS . . .

looks like a crayon
marks like a crayon
tells temperatures like a precision instrument

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000°F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

Also available in liquid and pellet form . . . Write **Welding Sales Dept.** for sample TEMPIL° pellets . . . State temperatures of interest — please!

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132 WEST 22nd ST., NEW YORK 11, N. Y.

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Pants, Aprons, Cape Sleeves, and Chaps for Weldors

- Full Cut
- Chrome Tanned Cowhide
- Soft and pliable
- Doubled Stitched
- Comfortable
- Durable

Write for descriptive literature and price information

ALJAY MANUFACTURING CO.
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Reduce Spot-Welding Rejects with

The Dice Microhm Meter

First developed by Dice, this instrument is now widely used in industry to maintain quality control and reduce rejects in the spot-welding of aluminum . . . by checking the surface resistance of sheets to see that they have been properly cleaned. The Dice Model 151-S measures resistances as low as ½ microhm in the low range to 750,000 microhms in the highest range. A low resistance reading indicates that the metal to be welded is properly cleaned. For free bulletin giving detailed information on how the Dice Microhm Meter can help you, write today

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"Non-destructive Testing and Measuring Instruments"

TFC

ORNAMENTAL IRON CASTINGS

MORE THAN 400 DESIGNS for making up ornamental iron grille work, columns, rails. A design for every style of architecture. Complete range of standard sizes.

Write for:

32-Page Catalog

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Please send 32-page catalog: "Everything for the Ornamental Iron Shop."

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

John B. Chamberlin will operate as vice president in charge of sales for Essex Welding Equipment Corp., Newark, N. J. He was formerly president of Interstate Welding Supply Corp., and has sold his interest in that firm to the Southern Oxygen Company.

John J. Brehany is chief engineer of all California Oxygen Co. liquid gas plants in California. He will operate from the La Habra office.

General Sales manager of Acoustica Associates, Mineola, N. Y. is *Ralph Reynolds*. He was technical sales manager.

B. W. Sauter has been named general manager of the Westinghouse Electronic Tube Div. in Elmira, N.Y.

Dr. Robert W. Lindsay, professor of metallurgy at Pennsylvania State University, will join the staff of Crucible Steel Co.'s central research laboratory in Pittsburgh. He will be supervisor of constructional alloy steels.

Lindberg Engineering Co., Chicago, has selected *Charles A. Mueller* as chief engineer of the new Gas Process Div., which handles development of atmosphere gas generation processes for heat treating and food and chemical industries.

Vice-president of fundamental research at United States Steel Corp., Pittsburgh, is *Dr. Oscar T. Marzke*. He was director of research at the U. S. Naval Research Laboratory.

Joel L. Valentine, Jr. has joined the sales organization of Metal & Thermit Corp. He will operate from the firm's offices in El Segundo, Calif.

Richard D. Kennedy takes over the new post of advertising and sales promotion manager of General Electric Receiving Tube Dept. He will direct advertising, sales promotion and publicity activities.

Paul Byrne is new sales manager of Tracerlab's western division at Richmond, Calif. He will be responsible for selling reactor instruments and other items. He was western district sales manager.

FOR SAFETY, SAVINGS and PROFIT

Do a good job of repairing welding hose for your customers.

Crimp ferrules or 3/16" or ¼" twin or single hose.
Eliminate dangerous hose connections.
Do a professional job without skill.

Packed with 8 splicers & 24 ferrules 7.40.
Packed tool only 4.50.

Order from your distributor or direct from us. C.O.D. postpaid

CRAIG WELDING SUPPLY COMPANY

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LEGAL NOTICE

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Welding Engineer published monthly (two issues in June) at Chicago, Ill., for October 1, 1957.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; Editor, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Managing editor, F. T. Tancula, 5826 Dempster St., Morton Grove, Ill.; Business manager, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Elsie R. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Anna B. Jefferson, 12 West 58th St. Terrace, Kansas City 13, Mo.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

T. B. JEFFERSON, Editor

Sworn to and subscribed before me this 27th day of September, 1957.

[SEAL] RALPH R. KASTEN

(My commission expires March 21, 1961

TILLMAN
Gloves—Garments

WELDORS BUY FROM YOUR DEALER

ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS
John Tillman & Co.
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» WELDING
Fundamental Principles and Practices «

THE ONLY HOME STUDY COURSE PREPARED AND ADMINISTERED FOR:

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- Welding Supervisors
- Drawing Office Men
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Over 450 8½" x 11" pages packed with Welding Know How

WELDING FUNDAMENTAL PRINCIPLES AND PRACTICES provides MANAGEMENT with a proven method of training Shop and Engineering personnel to specify, supervise and inspect Arc Welding.

MEN—you take this training in your own home at hours you yourself set. On successful completion you are awarded a handsome embossed CERTIFICATE — proof of a high level of achievement in the Welding field.

Write for More Information

National Technical Training Services
260 Delaware Avenue, Buffalo 2, New York

Welding engineer and metallurgist at Blaw-Knox Co.'s Buflovak Equipment Div., Buffalo, is *Michael Bender*. He will develop all welding procedures, advise and assist the engineering, manufacturing and inspection and sales departments on welding techniques, material and equipment, etc. Bender was formerly with Air Reduction Sales Co., Babcock and Wilcox Co., and Pittsburgh-Des-Moines Steel Co.

Prof. Robert A. Ratner, University of Wisconsin Extension Div. department of engineering, has been named director of Engineering Institutes. The institute program is a section of the extension division's department of engineering.

C. M. Schwitter has been promoted to head market research activities of International Nickel Co., Inc. *George Hoobler* will assist him. Schwitter was supervisor of Far Eastern and Latin American technical developments. The men will work in New York City.

General manager of Trent Tube Co.'s Fullerton, Calif., plant is *Fred E. Wenzel*. The West Coast plant is a wholly-owned subsidiary of Crucible Steel Co.

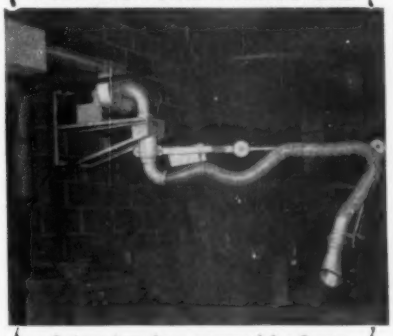
Died . . .

William F. Johnson, 62, was fatally injured in a freak accident Oct. 6. While on a hunting trip in the Leesburg mountains in Idaho, the car in which he was riding stuck on an incline. As he and two companions tried to push the car, it slipped and rolled backwards over Mr. Johnson.

He served as president of Johnson Welding Equipment Co., Chicago, the firm he founded in 1920. Funeral services were held Oct. 11 in Chicago.

M. C. Carson, 62, died Sept. 12, of a heart attack at his home in Chicago. For the past 17 years Mr. Carson served in Flood Safety Products Co.'s Chicago sales staff, and before that was with Sellstrom Mfg. Co. Funeral services were held in Chicago and Taylorville, Ill.

SAVE and be SURE with Engwald
WELDING FUME EXHAUSTERS



- Systems have been approved for Government Health Depts in U.S. & Canada
- Guaranteed for highest efficiency
- Portable & Stationary units for all applications
- Unlimited flexibility; fast, easy positioning over 360°
- Blowers attachable to units or mounted at remote points
- Units can be connected in series
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- Complete installations can be easily done by your own men
- Engwald Exhausters come complete with mounting brackets

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125 Sheridan Blvd.
Inwood, L. I., N. Y.
FRanklin 1-2222

JUST SWISH It over TORCHIE

"The Magic Lighter"

And You're Ready to GO on ANY Job!

- **No More Flint Lighters**
- **No More Open Flames**
- **Speeds Up Production**
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TORCHIE has revolutionized Torch Lighting EVERYWHERE and once you test it, you'll never part with it. Just SWISH your Torch over TORCHIE and BINGO!—an *instantaneous never-failing light*—costs only $9.95

Get Your TORCHIE on 30 Days Trial from your Welding Supply Distributor

THERMACOTE Company
108 So. De Lacey St.,
PASADENA CALIFORNIA

CLASSIFIED

THE WELDING SHOPPER

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED and RESALE

UNDISPLAYED RATE

(Not available for equipment advertising) 90c a line, minimum 6 lines. To figure advance payment, count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rate; minimum $5, payable in advance.

INFORMATION

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DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE

The advertising rate is $8.75 per inch for all advertising appearing on other than a contract basis. Maximum size of display ad is 4 col. in. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ in. vertically on one column, 3 columns—30 inches—to a page.

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PLANT SUPERINTENDENT

A leading manufacturer of pressure vessels and related products requires an energetic and progressive individual responsible for all plant manufacturing operations. The successful candidate must have:

- Unusually broad experience in layout, forming, setup and welding.
- • Experience in the fabrication and machining of pressure vessels to code specifications.
- • • Heavy management experience in developing supervisors to achieve results.

This position located in Northeastern Pennsylvania offers an unusual opportunity for personal recognition. Write to Box Number: 1106, C/O Welding Engineer, 5826 Dempster Street, Morton Grove, Illinois.

WELDING ENGINEER

Familiar with all types of welding methods with emphasis upon inert gas welding particularly with carbon dioxide shielding. Requires knowledge of all types of welding power units. Promotional work. Submit complete resume including past earning power and present salary requirement to:

Box No. 1108, C/O Welding Engineer,
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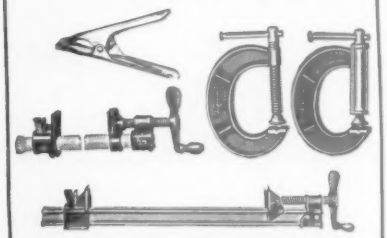
"Jorgensen" and "Pony" / CLAMPS

Write for free 32-page complete line catalog



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Adjustable Clamp Co.
"the clamp folks"
426 N. Ashland Ave. Chicago 22, Ill.

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To supervise *flash welding* chain by automatic equipment of German and Swedish design. Excellent opportunity. All applications will be held in strict confidence. Salary open for negotiation. Write and enclose resume or call

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Chester, Pa. Phone Chester 3-9271

Welding Specialist—Experienced in developing welding procedures and standards for manual arc welding with ability to apply same to high production for large steel boat manufacturer. Please give complete resume of past experience in first letter to:

ROAMER STEEL BOATS
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222 Lakewood Boulevard, Holland, Michigan

SITUATION WANTED

Young man presently employed as general manager, welding supply distributor, experienced in all phases distributor operation—sales, management, purchasing, etc., desires new connection with manufacturer or distributor. Energetic, sober and can furnish best of references, over 10 years experience. Reply Box No. 1110 c/o Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

Can you use 18 years of welding experience? Practical welding engineer, strong technical background. Welding sales and service, welding instructor and welding supervision. Wish to relocate—Resume available—Reply Harry Lane, 4105 So. Wayne Ave., Ft. Wayne, Ind.

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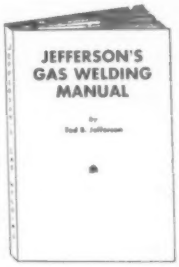
JEFFERSON'S GAS WELDING MANUAL

by Ted B. Jefferson



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Other chapters on How to Weld;

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SAVE YOUR OLD CUTTING TIPS

Send us your worn-out Oxygen-acetylene or propane cutting tips—For a fraction of the cost of a new tip, we'll make those "Worn-Out" tips **GOOD AS NEW.**

Each tip will be Reseated, Redrilled, Refinished and flame tested . . . then returned to you—Ready to give you the same service as a new tip.

Your cost for this service: Only $1.25 ea. Over 100 at $1.00 ea. Terms: 2% 10 days.

We condition tips of any style or make.

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THE WELDING SHOPPER

EQUIPMENT FOR SALE

LOW FUMING BRONZE RODS
for Gas Welding & Brazing
Bare & Flux Coated
AUFHAUSER BROTHERS
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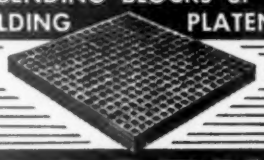
FOR SALE
Complete Air Products B 1000, 28 Meter Oxygen and Nitrogen producing plant. Will produce 1,000 cu. ft. oxygen or 600 cu. ft. nitrogen per hour, with liquid oxygen—nitrogen pump, C. P. Air Compressor, electric motor, starter, belts, etc.; air dryer, air purifier, vacuum pump and allied piping. Ready to run. WELDERS SUPPLY COMPANY, 608 Thomas Street, Little Rock, Arkansas.

ACORN
BENDING BLOCKS or WELDING PLATENS



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IRON & SUPPLY CO.
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LARGE QUANTITIES OF LOW HYDROGEN WELDING RODS AVAILABLE AT SACRIFICE PRICES
All other type Welding Rods in stock at large discounts
STANLEY KESSLER & COMPANY
20th & Atlantic Sts., Phila. 40, Pa.
SAgamore 2-2373

The following is a list of surplus material in our inventory which we are willing to sell at 50% of the replacement value:

300 lbs. — A110 .035 Silicon Bronze Aircomatic Wire

180 lbs. — 1/8" Dia. — 14" Lengths #72 Silicon Bronze Electrodes

48 lbs. — 1/8" Dia. — 14" Lengths #100 Silicon Bronze Electrodes

THE JACOB BRENNER CO.
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PLASTIC REGULATOR GAUGE LENS
For 2 1/2 in. and 2 in. gauges
Distributor prices on request.
SKYLINE WELDING EQUIPMENT & SUPPLY CO.
2626 Chicago Road
Chicago Heights, Illinois

EQUIPMENT FOR SALE

MANGANESE BRONZE GAS RODS (PAGE)
UNDERWATER ELECTRODES (MUREX CT)
Exceptionally Low Prices!
Appalachian Steel Corporation
Lyndhurst, N. J. GEneva 8-7070

FOR SALE
USED OXYGEN PLANT
Now operating . . . available in January, 1958. 6 Oxygen & Nitrogen Plants producing from 30 meters to 100 meters.
EXCELLENT CONDITION
Priced to sell immediately.
Write, wire or phone . . .
INDUSTRIAL AIR PRODUCTS CO.
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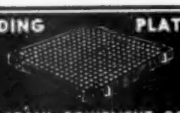
CUTTING MACHINES, AIRCO Camo & Radiagraphs and NATIONAL No. 5.
SEAM WELDER, Progressive, 150 KVA, New.
SPOT WELDER, National, 40 KVA, Used.
CUTTING TORCHES, Used, Oxweld, Airco, Harris.
WELDING TORCHES, New, Rego GV.
BRONZE—STAINLESS—AMPCOTRODES.
ELECTRODE HOLDERS.
RALL SUPPLY CO. 51 E. 42nd St., N.Y.C. 17

WELDING PLATENS



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94 Washington St. Brookline 46, Mass.

Closing Out Our Stock of Used and Surplus Oxygen Plants . . . All Items Offered Subject to Prior Sale

14 Complete 02B oxygen plants, new and ready to run including power unit. Excellent condition and mounted in tandem trailer. This unit will make 50 to 60 large cylinders of high-purity oxygen per day. Excellent for use in remote areas. We have large inventory of extra compressors and spare parts. Arrangements can be made to train your operators. Original acquisition cost $67,213.00 . . . Our special sale price . . . $9,250.00

9 Extra Curtis oxygen compressors for above.

1 Only Acetylene Plant, new, Linde type mounted in trailer van with undercarriage. Exceptionally clean. Can be purchased for a fraction of original cost . . . Our Special price $8,500.00

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Manufacturers
3332 West McDowell Road, Box 6276
Phoenix, Arizona, U.S.A.
Phone: AP 8-3531

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Welding School, Box U-1171, Troy, Ohio. for trained men. Learn quickly at best equipped school in U. S. Non-profit. G. I. approved. Catalog free. Write: Hobart Welding School, Box U-1171, Troy, Ohio.

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WELDING SUPPLY DIST. AUTO SHOP & MILL EQUIP. Big 3, top lines, exclusive territory, Est. 15 yrs. '56 gr. sls. 135 M Located fastest growing industrial area Puget Sound. State of Washington. Inv. & Equip. $35M. terms, lease guaranteed by owner. Reply Box No. 1102, c/o Welding Engineer, 5826 Dempster, Morton Grove, Ill.

FOR SALE
Welding and Blacksmith Shop Michigan—Fully Equipped for Industrial & Agricultural. Business established 12 years. Excellent opportunity for Shop Welder.
Write Box No. 1109, C/O Welding Engineer, 5826 Dempster St., Morton Grove, Ill.

A NICE REPEAT BUSINESS
JOBBERS WANTED IN EVERY CITY TO SELL "WELDER'S PAL" EYE DROPS
On the market for 20 years
CARHOFF COMPANY
11706 Kinsman Rd., Cleveland 20, Ohio

TRADE

DO YOU WANT TO TRADE?
We will swap any regulator that you send us, provided it has not been stripped of parts or gauges. In return for this trade we will send you a like regulator of the same make and size or one of another equally popular brand. Here is a chance to put into service those old regulators you have lying around. Turn them into useful products for loan equipment or have them on sale as reconditioned regulators. To keep costs down, we are asking all accounts to send checks to cover each transaction with the order. Please do no ask for open terms—this is a special deal. The cash difference between your equipment and ours is $7.50 for a single stage regulator and $8.50 for a two stage. Freight return paid by us. All apparatus is 100% guaranteed to your satisfaction or return to us freight collect. Send us a trial order today.
ATLANTIC WELDING SUPPLY
1100 W. 9th Street
Chester, Pa.

EQUIPMENT REPAIR

MAIL ORDER REPAIR HOUSE
Yes, that's right, we repair all makes of Regulators, Cutting & Welding equipment, Radiographs, Radiograph Motors, Machine Torches, & Cutting Tips for dealers. The pricing is handled on a minimum and maximum basis, pre-arranged. Some repaired parts and gauges, especially the type of equipment you handle, can be purchased at our most reasonable prices. So if you care to, you can send the repair parts to us, and we will only charge for the installation. Write for full details today, or better yet, send us a trial order today. You'll really be surprised. Let us be your repair station. We guarantee prompt service.
ATLANTIC WELDING SUPPLY
1100 W. 9th Street Chester, Pa.

free literature . . . . . USE CARD ON PAGE 119

51. ELECTRODE GUIDE—Air Reduction Sales Co. 70-page Electrode Pocket Guide (ADC 650G) features tabulated electrode consumption calculator, electrode color code and information on industrial and government specifications, etc.

52. JOINING ALUMINUM—All-State Welding Alloys Co., Inc. Pocket folder instructs how to solder, braze and weld aluminum and its alloys. Gives procedures for joining to dissimilar metals such as copper, nichrome, stainless steel, etc.

53. ANGLE CLAMP—Portomag, Inc. One man handles heavy-duty precision welding with electro-magnetic adjustable angle clamp, page proclaims.

54. BLAST CLEANER—Clementina Ltd. Folder pictures and describes portable blast cleaner for use in machinery areas, plant floors, etc.

55. PLATE SECTIONS—Colorado Fuel and Iron Corp. Fully-welded steel plate sections are detailed in a new 4-page folder. Gives advantages of welding over riveting.

56. PIPE FITTINGS—Tube Turns Plastics, Inc. Technical data and installation information on unplasticized polyvinyl chloride pipe, fittings and flanges.

57. ABRASIVE WHEELS—Electro Refractories & Abrasives Corp. Abrasive cut-off wheels for all applications and depressed center wheels for use with right angle grinders covered in bulletin GC-57.

58. LEAD PROTECTORS—O. G. Kelley & Co. Folder covers lead protectors for radiation shielding. Includes containers, vaults, walls, observation windows.

59. DISPENSER—Med-Fac Laboratories. Cream dispenser for all "Skin-Cote" products used to protect hands is detailed on illustrated page.

60. COOLANT—Harry Miller Corp. 8-page, 2-color booklet describes liquid that acts as a coolant, lubricant and rust preventive when mixed with water. Effective on cast iron, hard and soft steels and other ferrous metals.

61. SAFETY HATS—Fibre-Metal Co. Bulletin No. 45 pictures new SuperGard safety hats and caps; gives accessory part numbers.

62. MESH PRODUCTS—C. O. Jelliff Mfg. Co. Wire strainers and other mesh fabrications are detailed in folder. Mesh baskets are gas welded, other parts spot or seam welded.

63. ALLOY WIRE—H. K. Porter Co., Inc. Technical bulletin T-2 details special shaped alloy wire. Includes materials, sizes and limitations.

64. OXYGEN INDICATOR—Baker & Co., Inc. "Deoxo" indicator is described in booklet. Can detect 2 to 200 parts per million of oxygen in other gases.

65. CUTTING MACHINE—Wallace Supplies Mfg. Co. Rotary cutting unit to cut large diameter tubular sections is outlined in circular.

66. PLATED STRIP—Sylvania Electric Products Inc. Product bulletin "Plated metal strip," describes application of new process for plated strip in electrical-electronic industry.

67. FUME HOODS—Arthur S. LaPine & Co. Closed-type fume hoods used in industry, laboratories described in 2-page data sheet. Accessories listed.

68. WELDING SUPPLIES—Lincoln Electric Co. Booklet SB-1354 on automatic welding supplies includes information on electrodes and fluxes for submerged-arc welding and hardfacing.

69. ELECTRODE HOLDER—Martin Wells Inc. Illustrated page NWSA 390 details "Stubby" rod saver electrode holder.

70. RESISTANCE WELDING CONTROL—Robotron Corp. Booklet 361C covers resistance welding controls.

71. STUD WELDING—KSM Products, Inc. Studs and equipment for stud welding are listed in folder. Includes hand gun and production equipment.

72. REGULATORS—The Liquid Carbonic Corp. Two-stage regulator provides uniform flow as cylinder pressure decreases, pamphlet claims. Includes line of regulators.

73. BLAST CLEANING—Vacu-Blast Co., Inc. Two-color sheet gives special design features and operating advantages of blast cleaning machine.

74. ARC WELDING—Tweco Products, Inc. Twecolog No. 10 lists firm's arc welding products from electrode to machine.

75. FLASH PROTECTOR—Frommelt Industries, Inc. NWSA Index 980 treats portable "Spa-fla" safety welding shield which protects against sparks and flash.

76. FIRE EXTINGUISHER—The General Detroit Corp. Pamphlet covers line of fire extinguishers including dry chemical, carbon dioxide and vape-liquid types.

77. ALUMINUM JOINING—Eutectic Welding Alloys Corp. 6-page technical bulletin treats aluminum joining problems, covers metal joining and repair problems.

78. WELDERS—A. O. Smith Corp. "Building a winner" is a handbook on firm's line of welding machines. Shows step-by-step assemblage.

79. SOLENOID VALVE—Ross Operating Valve Co. 2-color catalog 311 gives flow diagrams and valve combinations of firm's line of solenoid valves.

80. TORCH—Velocity Power Tool Co. Page covers propane "Torch-o-matic" torch for soldering, burning, brazing, leading, sweating, etc.

81. HARDFACING—Coast Metals, Inc. Folder on tungsten carbide hardfacing covers welding recommendations and specifications.

82. FACILITIES—Gulton Industries, Inc. "From raw materials to complete systems" is a new facilities brochure on the firm's research and development program.

83. POSITIONING CONTROL—General Electric. Bulletin GEA-6594 describes an industrial system for automatic positioning of machines and machine tools.

84. INDUSTRIAL HISTORY—Bennett Machinery Co. Eli Whitney's contributions to modern industry are enumerated in an interesting booklet, "The founder of modern industry."

85. CHROMEL-A—Hoskins Mfg. Co. Metallurgical data and design information on Chromel-A, an 80-20 nickel-chromium alloy used as heating elements for high temperature electrical heating applications, included in catalog and manual M-57A.

86. CHEMICAL EXTINGUISHER—General Detroit Corp. One-hand operation with new 4-lb dry chemical fire extinguisher is claimed in folder.

87. RESISTANCE WIRE—Hoskins Mfg. Co. Chromel-A resistance wire and ribbon is covered in attractive catalog M-57A-2500.

88. STEEL TUBING—Babcock & Wilcox Co. Croloy steel pipe, tubing and welding fittings are described in technical data card 145-A.

89. CUTTING MACHINES—Indiana Oxygen Co. Booklet covers "Cut-a-line" model 1000, a portable cutting unit. Shows in operation, and gives price schedule.

90. DIAMOND WHEELS—Grinding Wheel Institute. The American Standards Association approved a new standard "Identification code for diamond wheel shapes," available in booklet form.

91. ACCESSORIES—Magnaflux Corp. Contact clamps, applicator guns, cables, lugs, connectors are some of accessories listed in form B-437-4-3M-3-56.

92. PLASTICS—Furane Plastics, Inc. Bulletin describes activities of plastic company, doing work in electronics, chemical and building industries.

93. BARREL BURNISHING—Oakite Products, Inc. Oakite FM 103 is new barrel burnishing compound detailed in service report. B-6644.

94. REGULATOR—K-G Equipment Co. New Jeep gas flow regulator described in NWSA Index 230.

95. SURFACE EQUIPMENT—Challenge Machinery Co. Precision surface equipment for tooling and production operations in metalworking and welding shops is described in catalog folder, publication 823.

96. VALVES—Automatic Switch Co. 3-way midget size solenoid valves for air, gas, water, light oil refrigerants is detailed in bulletin 8314.

97. SPEC MASK—Acme Protection Equipment Co. For people who must wear glasses under gas masks, a new "spec" mask gives protection with built-in spectacles.

98. X-RAY—Philips Electronics, Inc. 4-page folder deals with problems in pulse-height analyzers in X-ray work. Discusses construction, application and limitations.

99. END-WELD STUDS—Nelson Stud Welding Div. Information given on standard end-welding studs in 38-page manual "Stud specifications." Includes dimensions, size of weld fillets, annealing and flux.

100. METAL CLEANING—E. F. Houghton & Co. 52-page booklet on alkaline, acid emulsion and detergent cleaners, "Metal cleaning compounds," offered.

101. BURNERS—Selas Corp. of America. Bulletin S-1054 details "Selas superheat burners," for flame-hardening, flame-annealing, brazing, preheating, de-scaling, etc.

102. EARTHQUAKES—American Institute of Steel Construction, Inc. Selected bibliography on earthquake resistant design is available to all engineers and architects.

103. BERYLLIUM COPPER—Beryllium Corp. Technical bulletin 39 on beryllium copper, several automatic lock sliders for zippers.

104. NUCLEAR EQUIPMENT—Tracerlab, Inc. 28-page booklet gives description of nuclear laboratory equipment with line of counting, sample preparation, personnel protection, etc.

105. CASTING CERAMIC—Technion Design & Mfg. Co., Inc. Bulletin 108 is a 5-page report on "Sur-Braze S-2" casting ceramic for high temperature tooling.

106. CABLE SPLICER—Tweco Products, Inc. Form SP-100 directs a new, effective way to splice cable fast with new cable splicer, having ball point connection.

107. AUTOMATION—Thor Power Tool Co. A basic manual on multiple nut setting, "Automation in assembly," is offered. Includes stall type, multiple capacities and components.

108. ELECTRODE HOLDER — Lincoln Electric Co. Folder covers "Cooltong" fully insulated, 300 and 400 amp electrode holder.

109. STAINLESS STEELS—Arcos Corp. New 20-page booklet "A guide to better welding of stainless steels" is intended for experienced and new weldors. Answers many questions in question and answer form.

110. OXY-ACETYLENE PROCESSES—Linde Co. Modern oxy-acetylene processes (flame-planing, rivet-busting, mechanized shape-cutting and gouging) are illustrated and described in new 6-page booklet 1102.

111. INDUSTRIAL EQUIPMENT—General Industrial Co. Handbook of industrial equipment is available as a guide to executives. Describes new products, how to improve efficiency, etc.

112. STAINLESS STRIP—American Silver Co. Data sheet is devoted to ultra-thin and high-precision tolerance stainless steel strip. One section tabulates properties of hardenable types of the 300 series.

ADVERTISERS IN THIS ISSUE

This advertisers' index is included as a convenience and is in no way part of advertising contract. Although every care has been taken to index accurately some errors may have occurred and no allowance will be made for them.

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Literature offered in ads

125. Adjustable Clamp Co.—Catalog on complete line of "Jorgensen" and "Pony" clamps.

126. Air Reduction Sales Co.—To help you select the right electrode for your special job, send for the Airco Electrode Guide.

127. Air Reduction Sales Co.—Write for further information on the #48 Duograph, Travograph, Oxygraph, Monograph, Camograph, and Radiagraph.

128. Air Reduction Sales Co.—Write for Catalog 1318 for further information on Airco electrodes for all-'round welding.

129. Aljay Mfg. Co.—Write for descriptive literature and price information on Aljay's weldor clothing.

130. Alloy Rods Co.—For further information on Nickel-Arc electrodes write for a copy of Bulletin AR-2.

131. All-State Welding Alloys Co.—Write for new instruction book on 62 alloys and fluxes.

132. American Brass Co.—Write for a copy of publication B-13 to help you select the exact rod for your job.

133. American Optical Co.—For complete details on fiber glass welding helmets write for new brochure S-6311.

134. American Platinum Works—Write for two complete reference manuals for low-temperature silver brazing and fluxing.

135. Ampco Metal, Inc.—Write for the free monthly inventory list of Ampco-Weld rod and bar stock.

136. Anti-Borax Compound Co., Inc.—For further information write for descriptive booklet and samples of case-hardening powder.

139. Aronson Machine Co.—Write for detailed engineering data on Aronson positioners.

140. Aro Spot Welders Div.—Write for illustrated literature on the new Aro model 410 portable spot welder.

141. Atlas Welding Accessories Inc.—Write for data on complete weld-cleaning tool line.

142. Balteau Electric Corp.—Details on new, low-cost X-ray portable unit.

143. Belden Mfg. Co.—Write for further information on Belden wire.

144. Burdett Oxygen Co.—Write for literature on Burdox Statosec cutting machine.

145. Bernard Welding Equipment Co.—Write for further information on "Short-stub" electrode holders.

146. Cam-Lok Div. Bulletin No. 243 contains full information on the new "Kit and Cable Splicer."

147. Carol Cable Div.—Write for further information on "Dynapower" arc-welding cables.

148. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

149. Contour Marker Corp.—Details on establishing and marking a point at any angle.

150. Coyne Cylinder Co.—Details and prices on acetylene cylinders.

215. Craig Welding Supply Co.—Write for further information on repairing welding hoses.

151. Crucible Steel Co. of America—Details on automatic welding wire for cleaner, faster, sounder welds.

152. J. W. Dice Co.—Write for free bulletin giving detailed information on how the Dice Microhm Meter can help you.

153. Drawalloy Corp.—Write for bulletin 355-DC for complete information on every grade of Drawalloy welding wire.

154. Engwald Corp.—Write for Bulletin W-11 on Engwald welding fume exhausters.

155. Eutectic Welding Alloys Corp.—Send for the new 1958, 180-page pocket-size "Welding Data Book."

156. The Federal Machine and Welder Co.—Information on an automated production line ready made to produce a part to specification.

157. The Fibre-Metal Products Co.—Write for Bulletins for further information on Fibre-Metal protection wear.

158. Flood Safety Products Co.—Data on heat and moisture-resistant "No. 14" fiber glass and "No. P-14" all-plastic ratchet-type helmets.

159. General Split Corp.—Write for further information on "Weldtan" heat-resistant leather for your work gloves.

160. Goldsmith Bros. Smelting & Refining Co.—"GB Data Book" gives complete information on low-temperature silver-brazing.

161. H & M Pipe Beveling Machine Co.—Write for fully illustrated details of the complete H & M line.

162. Handy & Harman—Write for bulletin 20 introducing you to silver alloy brazing.

163. Harnischfeger Corp.—Data on "P& H" low-hydrogen electrodes to match the chemical or mechanical properties of any problem alloy.

163. Harnischfeger Corp.—Write for a copy of "What you should know about Welding Positioners."

164. Harris Calorific Co.—Write for further information on Harris gas welding and cutting equipment.

165. Hobart Bros. Co.—Write for complete information on Hobarts arc welding equipment.

166. Hobart Bros. Co.—Write for information on trying the new "Rocket 10ip" welding electrode.

167. Hoeganaes Sponge Iron Corp.—Write for Bulletin 106 which tells why you can expect improved performance with iron powder coated electrodes.

168. Independent Engineering Co., Inc.—Write for details on how to reduce cylinder handling with gas supply trailers.

169. International Nickel Co., Inc.—Send for your copy of "Repair Cast Iron Parts Quickly and Easily" which gives illustrated examples of the many jobs you can do with "Ni-Rod 55" electrode.

170. Invincible Vacuum Cleaner Mfg. Co.—Send for folder on Invincible flux recovery systems.

171. Jackson Products—Write for further information on Jackson's insulated copper alloy holders, ground clamps, cable connectors, and splicers.

173. Kedman Co.—Information on welding helmets, face shields and accessories.

174. Lenco, Inc.—Write for further information on Hi-Amp electrode holder to fit every manual arc welding requirement.

175. Lepel High Frequency Laboratories, Inc.—Catalog contains information on high-frequency induction heating units for brazing, annealing, hardening soldering and melting.

176. Lincoln Electric Co.—For further information on the Lincoln Model S-6090 write for bulletin SB-1337.

177. Linde Co.—Write for free Catalog F-4487 on the complete line of Oxweld portable cutting machines.

178. Linde Co.—Write for booklet on "X-7" anti-spatter compound.

179. Linde Co.—Write for booklet "Modern Methods of Joining Metals" to find out how Linde Sigma apparatus and Linde argon can help improve your product and increase your production.

180. Liquid Carbonic Corp.—Send for complete technical data on new CO_2 shielded gas welding.

181. P. R. Mallory & Co.—Write for name and address of Mallory distributor serving your area.

182. Merrill Brothers—Information on lifting clamps, twin and drum lifters, drum tilters and other material-handling devices.

183. Metal & Thermit Corp.—To find the correct rod or wire for any particular welding application write for the 24-page "Electrode Selector."

184. Miller Electric Mfg. Co., Inc.—Complete specifications available on new "Miller AEA-200-L" welding machine.

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 90 to 102

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For additional information on New Products described in this issue, circle the numbers and the items that interest you. The New Products section begins on page 90.

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Literature offered in ads

(Continued from page 118)

185. Miller Electric Mfg. Co., Inc.—Write for further information on the "Gold Star" electrically controlled welder.

186. National Carbide Co.—Write for name and address of nearest supplier.

187. National Cylinder Gas Co.—Write for the new NCG bulletin NH-137 on Dual Shield welding.

188. National Technical Training Services—Write for further information on the home study course of welding.

189. National Welding Equipment Co.—Write for free brochure No. 4,—44 pages with interesting information and 30 color and black and white pictures.

190. Norris-Thermador Corp—Write for specifications, size and prices of acetylene cylinders.

191. Page Steel & Wire Div.—Send for folder DH-1277, "Gas Welding Rods."

192. Phoenix Products Co.—Information on "Dry Rod" electrode ovens.

193. Picker X-Ray Corp.—Write if you have an inspection problem and a consulting radiographer will call on you free of charge.

194. Rankin Mfg. Co.—Write for the new Ranite Select-O-Graph Guide.

195. Robotron Corp.—Write for the new bulletin "Industrial Electronics For you . . . From Robotron."

196. Ruemelin Mfg. Co.—Write for Bulletin No. 37E on fume collectors that eliminate harmful fumes, heat and smoke at their source.

197. Sellstrom Mfg. Co.—Write for Sellstrom Bulletin 33-C for further information on the "619" and "621" jumbo chipping goggles.

198. Shoot-A-Lite Corp.—Literature on safety gas lighter for welding and cutting torches.

199. A. O. Smith Corp.—Write for further information on the A. O. Smith d-c rectifier and also for a demonstration.

200. A. O. Smith Corp.—Write for further information on the SW-44 and other top-performing electrodes.

201. Smith Welding Equipment Corp.—Write for further information on the new lightweight "Pipeliner" torch.

202. Square D Co.—Write for high Speed Welder Control Bulletin #8992.

203. Stulz-Sickles Co.—Write for "How-to-do-it" bulletin and name and address of nearest distributor.

204. Sylvania Electric Products Inc.—Details on complete line of color-coded electrodes for Tig welding.

205. Tempil Corp.—Information on, and sample of, pellets (state temperatures of interest) of temperature indication materials for all heat-dependent operations.

206. Tennessee Fabricating Co.—32-page catalog lists "Everything for the Ornamental Iron Shop."

207. Thermacote Co.—Write for name and address of your nearest distributor.

208. Tillman & Co., John—Catalog on weldor's gloves and garments.

209. Tube Turns—Send for a copy of "Standard for Butt-Welded Carbon Steel Piping Systems" Covers materials, assembly methods and welding procedures to use for safe, economical and maintenance-free piping.

210. Unique Equipment Inc.—Details on precision welding head manipulators and welding positioners.

211. United Specialties, Inc.—Complete information on "Weldreel" welding hose and cable reels.

212. Victor Equipment Co.—Write for the "Victor Hardfacing Manual" showing you the right rod to use and how to apply it.

213. Victor Equipment Co.—Write for Cutting Tips Bulletin 214 to help you select the right tip for your job.

214. York Engineering Co.—Write for further information on the Spat-R-Pruf Compound 106.

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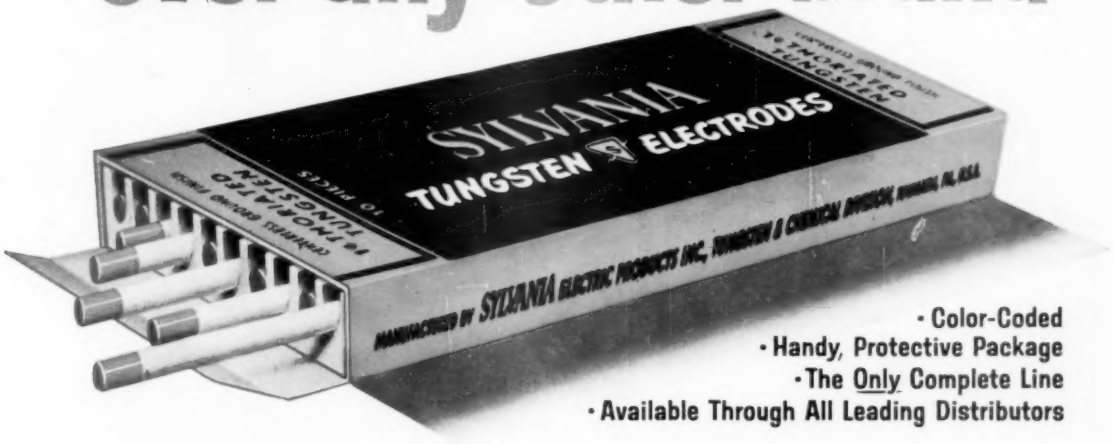
Here's why welders prefer Sylvania Electrodes over any other brand



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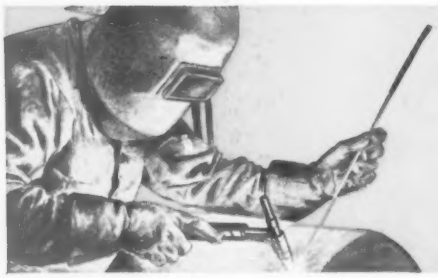

WELDING ROD CLINIC

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The American Brass Company, Waterbury, Conn.

Fast, economical sheet metal fabrication with copper-alloy rods

The time-saving advantages of welding such sheet steel items as ducts, piping, cabinets, gear guards, etc., are often ignored because of poor experience with some welding methods, and the assembling is done by riveting or by riveting and soldering. One reason, of course, is the difficult control of weld metal when metal-arc welding on light-gage metal, plus the added problem of slag and spatter removal. Another reason is the relatively slow speed of oxyacetylene fusion welding and the excessive distortion it produces.

Advantages of copper-alloy rods. By contrast, carbon-arc and inert-gas tungsten-arc welding are easily controlled and produce no slag or spatter. When used with a copper-alloy filler rod, like Everdur-1010, there is only minimum fusion of the base metal, so that weld-metal control is further improved. Distortion is at a minimum because of the narrow heat-affected zone produced by the concentrated heat source and the high welding speeds possible.

Preserve zinc coating. The narrow heat-affected zone so produced also makes these processes especially attractive for welding galvanized steel, since they cause the least possible disruption of the zinc coating. When made with a nonrusting copper-alloy welding rod, the joints are the most dependable that can be obtained.

Duct of 18-gage galvanized sheet metal is fabricated with 1/8" Everdur®-1010 Welding Rod by the carbon-arc method. Seams were first tack-welded, then welded around the periphery.

For this reason, the use of Everdur-1010 Welding Rod with these processes is becoming increasingly popular with fabricators of structural elements, vats and ducts of galvanized steel.

Best results in welding plain and galvanized metal depend on melting the least possible amount of the steel. This is readily achieved by holding a very short arc and keeping it always on the bronze weld metal. Weaving is avoided as much as possible. Of course, these precautions also serve to produce the least effect on the zinc coating alongside the weld.

The joint types usually employed in sheet metal work—square butt, lapped, edge, and corner welds—are also suitable for use with these processes.

For best results. The carbon-arc process is satisfactory for most purposes, and does the work with ease and economy. Better results, of course, may be obtained with the inert-gas tungsten-arc. For the latter process, either argon or helium may be used for shielding. Welding current employed should be just high enough to develop welding speeds that can be easily maintained by the operator.

For more information. Anaconda distributors will gladly help in the selection of the exact rod for your job. Or write for a copy of Publication B-13. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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Welding angle frame of galvanized steel by inert-gas tungsten-arc process with Everdur-1010 Welding Rod. Frame was welded on both sides, laying a relatively small bead.

ANACONDA®
WELDING RODS
made by
The American Brass Company

Carbon-arc braze welding on a frozen food cabinet production line. Corner seams on .0418" steel are welded with 1/8" Everdur-1010 Welding Rod.